Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults (Review)

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[Intervention Review]

Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

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ABSTRACT

Background

Two types of implants used for the surgical fixation of extracapsular hip fractures are cephalocondylic intramedullary nails, which are inserted into the femoral canal proximally to distally across the fracture, and extramedullary implants (e.g. the sliding hip screw).

Objectives

To compare cephalocondylic intramedullary nails with extramedullary implants for extracapsular hip fractures in adults.

Search strategy

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (June 2007), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2007, Issue 2), MEDLINE (1966 to June week 3 2007), EMBASE (1988 to 2007 Week 27), the UK National Research Register, orthopaedic journals, conference proceedings and reference lists of articles.

Selection criteria

All randomised and quasi-randomised controlled trials comparing cephalocondylic nails with extramedullary implants for extracapsular hip fractures.

Data collection and analysis

Both authors independently assessed trial quality and extracted data. Wherever appropriate, results were pooled.

Main results

Predominantly older people with mainly trochanteric fractures were treated in the 36 included trials.

Twenty-two trials (3871 participants) compared the Gamma nail with the sliding hip screw (SHS). The Gamma nail was associated with an increased risk of operative and later fracture of the femur and an increased reoperation rate. There were no major differences between implants in the wound infection, mortality or medical complications.

Five trials (623 participants) compared the intramedullary hip screw (IMHS) with the SHS. Fracture fixation complications were more common in the IMHS group; all cases of operative and later fracture of the femur occurred in this group. Results for post-operative complications, mortality and functional outcomes were similar in the two groups.

Three trials (394 participants) showed no difference in fracture fixation complications, reoperation, wound infection and length of hospital stay for proximal femoral nail (PFN) compared with the SHS.

Single trials compared the Targon PF nail versus SHS (60 participants); experimental mini-invasive static intramedullary nail versus SHS (60 participants); Kuntscher-Y nail versus SHS (230 participants); Gamma nail versus Medoff sliding plate (217 participants); and PFN versus Medoff sliding plate (203 participants). These trials provided insufficient evidence to establish differences between these implants.

Two trials (65 participants with reverse and transverse fractures at the level of the lesser trochanter) found intramedullary nails (Gamma nail or PFN) were associated with better intra-operative results and fewer fracture fixation complications than extramedullary implants (a 90-degree blade plate or dynamic condylar screw) for these fractures.

Authors' conclusions

Given the lower complication rate of the SHS in comparison with intramedullary nails, SHS appears superior for trochanteric fractures. Further studies are required to determine if different types of intramedullary nail produce similar results, or if intramedullary nails have advantages for selected fracture types (for example, subtrochanteric fractures).

PLAIN LANGUAGE SUMMARY

Cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Hip fractures located outside the hip joint capsule (extracapsular hip fractures) may be surgically fixed using a variety of implants. One particular type of implant is the sliding hip screw. This consists of a screw that is inserted into the upper part of the thigh bone (femur) to bridge (fix) the fracture. This screw can move within a metal barrel connected to a plate that is screwed to the outside of the femur (extramedullary). Other implants take the form of intramedullary nails. The nails considered here are inserted from the top of the femur into the inner cavity of the femur bone (intramedullary) and held in place with screws. This review compared these two types of implants in predominantly older populations.

The main results were for the comparisons of four types of intramedullary nails with the sliding hip screw. Twenty-two trials, involving 3871 participants, tested the Gamma nail. Five trials, involving 623 participants, tested the intramedullary hip screw (IMHS). Three trials, involving 394 participants, tested the proximal femoral nail. One trial of 60 participants tested the Targon PF nail. Pooled results from these trials showed that nails are associated with an increased risk of fracture of the thigh bone both during and after the operation. The review found that using cephalocondylic nails resulted in one extra reoperation in every 50 people. Mortality and other long-term outcomes were similar between the implants.

The review concluded that, given the lower complication rate of the sliding hip screw in comparison with intramedullary nails, the sliding hip screw appears to be a better implant for fixing the more common types of extracapsular hip fractures.

BACKGROUND

Hip fracture is the general term for fracture of the proximal (upper) femur. These fractures can be subdivided into intracapsular fractures (those occurring within or proximal to the attachment of the hip joint capsule to the femur) and extracapsular (those occurring outside or distal to the hip joint capsule). Extracapsular fractures are further defined as those fractures that traverse the femur within the area of bone bounded by the intertrochanteric line proximally up to a distance of five centimetres below the distal part of the lesser trochanter. Numerous subdivisions and classification methods exist for these fractures. Other terms used to describe these fractures include trochanteric, subtrochanteric, pertrochanteric, intertrochanteric, basal and lateral femoral fractures (Parker 2002). The most practical classification and that used for this review is the division into stable trochanteric fractures (AO classification type A1), unstable trochanteric (AO classification type A2), and transtrochanteric which includes those fracture lines at the level of the lesser trochanter and reversed fracture lines (AO classification type A3) (Muller 1991).

Operative treatment of extracapsular hip fractures was introduced in the 1950s using a variety of different implants. Implants may be either extramedullary or intramedullary in nature. The most commonly used extramedullary implant is the sliding hip screw (SHS) which is synonymous with the term compression hip screw and equivalent models such as the Dynamic, Richards or Ambi hip screws. The SHS consists of a lag screw passed up the femoral neck to the femoral head. This lag screw is then attached to a plate on the side of the femur. These are considered 'dynamic' implants as they have the capacity for sliding at the plate/screw junction to allow for collapse at the fracture site. The Medoff plate (Medoff 1991) is a modification of the sliding hip screw. The difference is that the plate has an inner and outer sleeve, which can slide between each other. This creates an additional capacity for sliding to occur at the level of the lesser trochanter as well as at the lag screw. Sliding at the lag screw can be prevented with a locking screw to create a 'one way' sliding Medoff instead of a 'two way' sliding Medoff. At a later date the locking device on the lag screw can be removed to 'dynamise' the fracture.

Static implants include the fixed nail plates such as the Jewett and the McLaughlin nail plates. The 90-degree blade plate is also a static implant of a more recent design. Though, theoretically, the Dynamic condylar screw plate has the capacity for sliding at the screw plate junction, it is more likely to act as a fixed device when used at the hip, with no slide occurring.

Intramedullary nails used for internal fixation of extracapsular fractures can either be inserted from distal to proximal (condylocephalic nails) or from proximal to distal (cephalocondylic nails). Condylocephalic nails are inserted at the level of the femoral condyle above the knee and passed across the trochanteric fracture and up into the femoral head. These are the subject of another review (Parker 1998). Cephalocondylic nails are inserted through the greater trochanter of the femur and secured by a cross pin or screw which is passed up the femoral neck into the femoral head. Theoretical biomechanical advantages of these intramedullary nails over screw and plate fixation are attributed to a reduced distance between the hip joint and the implant, which diminishes the bending moment across the implant/fracture construct. Examples of these intramedullary nails are the Gamma nail, the intramedullary hip screw (IMHS), the proximal femoral nail (PFN), the Targon PF (proximal femoral) nail and the Kuntscher-Y nail (Cuthbert 1976). These nails plus an experimental nail tested in Dujardin 2001 are described in Table 1.

Table 1. Intramedullary nails evaluated by the included trials

Name	Description
Gamma nail	The Gamma nail (Howmedica Ltd) was introduced in the late 1980s for the treatment of extracapsular hip fractures. The implant consists of a sliding lag screw which passes through a short intramedullary nail. One or two screws may be passed through the nail tip to secure it to the femoral shaft (distal locking). Theoretical advantages of this implant are due to a percutaneous insertion technique and include reduced blood loss, reduced sepsis, minimal tissue trauma and short operating time. Modifications to the design of the Gamma nail and its instrumentation have occurred since its introduction. The trochanteric Gamma nail is referred to as a third generation Gamma nail. It is shorter in length than the standard Gamma nail (200 mm versus 180 mm), has a lower mediolateral curvature (4 degrees) and has a diameter of 17 mm proximally and 11 mm distally.
Intramedullary hip screw (IMHS)	The IMHS (Richards Medical Ltd) - length 210 mm - was introduced in 1995 for the treatment of extracapsular femoral fractures. Like the Gamma nail, it consists of a nail inserted via the greater trochanter into the medullary cavity and a lag screw, which is passed up the femoral neck to the head.
Proximal femoral nail (PFN)	The PFN (Synthes Ltd) - length 240 mm - was introduced in 1998 for the treatment of extracapsular fractures. Like the Gamma and IMHS, it consists of a nail inserted via the greater trochanter in to the medullary cavity. Two proximal lag screws are passed up the femoral neck to the head.

Table 1. Intramedullary nails evaluated by the included trials (*Continued*)

Targon PF (proximal femoral) nail	The Targon PF nail - length 220 mm - is also inserted in a similar fashion into the intramedullary cavity. Proximally, this nail has a sliding lag screw and an antirotation pin.
Experimental nail (reported in Dujardin 2001)	An experimental mini-invasive static intramedullary nail, which is not commercially available, is reported in Dujardin 2001. This consists of an intramedullary nail which is 170 millimetres long with a distal diameter of 12 millimetres and a proximal diameter of 13 millimetres. There are two five millimetre distal locking holes. The proximal hold of the femur is with two seven millimetre cannulated screws which diverge at a 30 degrees angle. Unlike the other proximal femoral nails, there is no sliding mechanism within the nail construct.
Kuntscher-Y nail	The Kuntscher-Y nail (Cuthbert 1976) is an early design of an intramedullary nail. It consists of a side arm and a separate slotted Kuntscher nail. The side arm is passed up the femoral neck, and then attached to an alignment jig to enable a slotted Kuntscher nail to be passed via the greater trochanter through a hole in the side arm and distally within the medullary cavity. The assembled implant construct has no capacity for sliding at the side arm and neither has it the capacity for distal locking.

This review compares different types of cephalocondylic nails with extramedullary implants: a review comparing different intramedullary nails for these fractures is now available (Parker 2006).

OBJECTIVES

To compare the relative effects (operative details, fracture fixation complications, post-operative complications, anatomical restoration, final outcome measures) of cephalocondylic intramedullary nails versus extramedullary fixation implants for treating extracapsular proximal femoral (hip) fractures in adults.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised or quasi-randomised (e.g. alternation) controlled trials comparing all types of cephalocondylic intramedullary nails with extramedullary implants.

Types of participants

Skeletally mature patients with an extracapsular proximal femoral fracture. In presenting trial details and results, consideration is given to the type of fractures (e.g. stable or unstable trochanteric fractures, subtrochanteric fracture) were included and what fractures (e.g. pathological fractures due to malignancy) were excluded from individual trial populations.

Types of interventions

Surgical fixation of the fracture with a cephalocondylic nail or extramedullary implants.

Types of outcome measures

The following outcomes were sought.
(1) Operative details

- length of surgery (in minutes)
- operative blood loss (in millilitres)
- number of patients transfused
- radiographic screening time (in seconds or minutes)

(2) Fracture fixation complications

- operative fracture of the femur (around or below the implant, but excluding comminution of the fracture site)
- later fracture of the femur (around or below the implant)

- cut-out of the implant from the femoral head
- non-union of the fracture
- detachment of the implant from the femur
- breakage of the implant
- all technical complications of fixation (sum of above six outcomes with the addition of any other major complications of fracture healing as specified in each study. Major complications were defined as those which generally required revision surgery or a change of surgical procedure during the primary operation, such as using a longer nail. Excluded from this are minor operative complications, such as comminution of the fracture site during surgery, and minor fracture healing complications such as breakage of the locking screws or backing out of pins or screws)
- reoperation (within the follow-up period of the study)
- wound infection: any (i.e. deep or superficial) or all deep wound infection (i.e. infection beneath the deep fascia)
- wound haematoma

(3) Post-operative complications

- pressure sores
- pneumonia
- thromboembolic complications (deep vein thrombosis or pulmonary embolism)
- any medical complication (as detailed in each individual study, excluding wound infections)
- length of hospital stay (in days)

(4) Anatomical restoration

- leg shortening (preferably using the criterion of a >2 cm reduction)
- varus deformity
- external rotation deformity (preferably using the criterion of a >20 degrees deformity)

(5) Final outcome measures

- mortality (within the follow-up period of the study)
- pain (persistent pain at the final follow-up assessment)
- mobility and use of walking aids
- failure to return to pre-fracture residential status
- functional activities of daily living
- composite function and hip scores

In our methodology quality assessment tool (see Methods) we have specified six-months follow up for all surviving trial participants as being acceptable. However, longer-term follow up of at least one year or, better still, two years is preferable to get a full view on mortality, function and reoperation resulting from complications and implant failure.

Search methods for identification of studies

Electronic searches

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (June 2007), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2007, Issue 2), MEDLINE (1966 to June week 3 2007) and EMBASE (1988 to 2007 Week 27). We searched the UK National Research Register Issue 2, 2007 (http://www.update-software.com/National/nrr-frame.html) and Current Controlled Trials at www.controlled-trials.com (accessed June 2007) for ongoing and recently completed trials. No language restriction was applied.
The generic search strategies for hip fracture trials in *The Cochrane Library* (Wiley Interscience) and MEDLINE (2002 onwards) are shown in Appendix 1. This MEDLINE search was combined with all three stages of the optimal trial search strategy (Higgins 2005). The general search strategy for hip fracture trials in EMBASE (2002 onwards) is shown in Appendix 2.

Searching other resources

We searched reference lists of articles and our own reference databases. We included the findings from handsearches of the British Volume of the Journal of Bone and Joint Surgery supplements (1996 onwards) and abstracts of the American Orthopaedic Trauma Association annual meetings (1996 to 2006: http://www.hwbf.org/ota/am/) and American Academy of Orthopaedic Surgeons annual meeting (2004 to 2007: www.aaos.org/wordhtml/libscip.htm). We also included handsearch results from the final programmes of SICOT (1996 & 1999) and SICOT/SIROT (2003), EFFORT (2007) and the British Orthopaedic Association Congress (2000, 2001, 2002, 2003, 2005 and 2006). We scrutinised weekly downloads of "Fracture" articles in new issues of 15 journals (Acta Orthop Scand; Am J Orthop; Arch Orthop Trauma Surg; Clin J Sport Med; Clin Orthop; Foot Ankle Int; Injury; J Am Acad Orthop Surg; J Arthroplasty; J Bone Joint Surg Am; J Bone Joint Surg Br; J Foot Ankle Surg; J Orthop Trauma; J Trauma; Orthopedics) from AMEDEO (www.amedeo.com). We contacted Howmedica Ltd UK (manufacturers of the Gamma nail) and Richards Ltd (manufacturers of the Intramedullary Hip Screw) and corresponded with colleagues.
Details of other searches conducted prior to 2000 are documented in Appendix 3.

Data collection and analysis

Selection of studies

Both review authors independently assessed potentially eligible trials for inclusion. Any disagreement was resolved by discussion.

Data extraction and management

Data for the outcomes listed above were independently extracted by both review authors and any differences resolved by discussion. Where necessary and practical, we contacted trialists for additional data and clarification.

Assessment of risk of bias in included studies

Each trial was assessed independently without masking by both authors for its quality of methodology and a consensus reached where there were differences. The main assessment was by the method of randomisation, which was also separately graded A, B or C according to the scheme within the Cochrane Handbook. In total, 11 aspects of methodology were rated (see Table 2). The scores of the individual items were no longer summed from 2007 onwards.

Table 2. Methodological quality assessment scheme

Items	Scores
1. Was there clear concealment of allocation?	Score 3 (and code A) if allocation was concealed (e.g. numbered sealed opaque envelopes drawn consecutively). Score 2 (and code B) if there was a possible chance of disclosure before allocation. Score 1 (and code B) if the method of allocation concealment or randomisation was not stated or was unclear. Score 0 (and code C) if allocation concealment was clearly not concealed such as those trials using quasi-randomisation (e.g. even or odd date of birth).
2. Were the inclusion and exclusion criteria clearly defined?	Score 1 if text states the type of fracture and which patients were included and/or excluded. Otherwise score 0.
3. Were the outcomes of trial participants who withdrew or excluded after allocation described and included in an intention-to-treat analysis?	Score 1 if yes or text states that no withdrawals occurred, or data are presented that, by clearly showing 'participant flow', allow this to be inferred. Otherwise score 0.
4. Were the treatment and control groups adequately described at entry and if so were the groups well matched or appropriate covariate adjustment made?	Score 1 if at least four admission details given (e.g. age, sex, mobility, function score, mental test score, fracture type) with no significant difference between groups or appropriate adjustment made. Otherwise score 0.
5. Did the surgeons have prior experience of the operations they performed in the trial, prior to its commencement?	Score 1 if text states there was an introductory period or that surgeons were experienced. Otherwise score 0.
6. Were the care programmes other than trial options identical?	Score 1 if text states they were or if this can be inferred. Otherwise score 0.
7. Were the outcome measures clearly defined in the text with a definition of any ambiguous terms encountered?	Score 1 if yes. Otherwise score 0.

Table 2. Methodological quality assessment scheme *(Continued)*

8. Were the outcome assessors blind to assignment status?	Score 1 if assessors of pain and function at follow up were blinded to treatment outcome. Otherwise score 0.
9. Was the timing of outcome measures appropriate?A minimum of six-months follow up for all surviving trial participants.	Score 1 if yes. Otherwise score 0.
10. Was loss to follow up reported and if so were less than five per cent of trial participants lost to follow up?	Score 1 if yes. Otherwise score 0.
11. Were the authors able to provide supplementary details of the trial in addition to published data?	Score 1 if yes. Otherwise score 0.

Data synthesis

For dichotomous outcomes, we report relative risks (RR) with 95% confidence intervals and for continuous outcomes, weighted mean differences (WMD) and 95% confidence intervals. Results of comparable groups of trials were pooled using both the fixed-effect and random-effects models. Heterogeneity between comparable trials was tested using a standard chi² test, with additional consideration of the I² statistic (Higgins 2003). The results for the random-effects model are presented when there is significant heterogeneity ($P < 0.10$; $I^2 > 50\%$) in the results of individual trials.

Sensitivity analysis

Some exploratory sensitivity analyses, based on allocation concealment and the reportage of surgical experience, were performed to test potential bias.

The choice of denominators for post-operative outcomes such as non-union and cut-out often presented difficulties as it was often unclear if these outcomes were measured or reported in all patients, especially those who eventually died. Some studies clearly stated when and to whom the results for a specific outcome applied and we have used these data here. In those studies for which it was unclear, we have selected the denominators which seemed the most appropriate based on the reported data. These have usually been the numbers randomised or alive at follow up. Sensitivity analyses using numbers randomised were done for all outcomes where such choices had been made in order to check for significant changes in results.

R E S U L T S

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of ongoing studies.

In all, 60 trials were identified of which 36 were included, 19 excluded, one is ongoing, and four are awaiting assessment.

Four newly reported trials were included in this update. These were Ovesen 2006 which compared the Gamma nail with the sliding hip screw (SHS); Ekstrom 2007 which compared the proximal femoral nail (PFN) with the SHS; Giraud 2005 which compared the Targon PF nail with the SHS; and Papasimos 2005 which compared three implants: the Gamma nail, the PFN and the SHS (*see* the 'Characteristics of included studies' for details). Further unpublished details were obtained for an already included trial (Mehdi 2000).

Of the six other newly identified studies, five were excluded (Azzoni 2004; Bienkowski 2006; Kafer 2005; Klinger 2005; Tarantino 2005) (*see* the 'Characteristics of excluded studies' for details).

The remaining newly identified study (Harris 2005), is awaiting assessment as it is only available as a conference abstract. A trial previously listed as ongoing is now awaiting assessment after identifying a conference abstract (Fernando 2006 formerly Khaleel).

Details of the ongoing trials are presented in the 'Characteristics of ongoing studies'.

The trial populations for the various implant comparisons in the included trials are summarised below.

Gamma nail versus SHS

Twenty-two trials (Adams 2001; Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Hoffman 1996; Kukla 1997; Kuwabara 1998; Leung 1992; Marques Lopez 2002; Michos 2001; Mott 1993; O'Brien 1995; Ovesen 2006; Pahlpatz 1993; Papasimos 2005; Park 1998;

Radford 1993; Utrilla 2005) compared the Gamma nail with the SHS in 3871, predominantly older, people. However, Benum 1994 was a multi-centre study for which data were only available for a subgroup of hospitals. Ahrengart 2002 was the other multi-centre study (Ahrengart 1994), which was based in Scandinavian countries. Since the results for participants with subtrochanteric fractures and 66 others who were lost to follow up were not published in the full report of the trial (Ahrengart 2002), we continue to present the results from two centres reported in Fornander 1994. This means that the results for only 3080 trial participants, with 3082 fractures, are included in this review.

Eight trials (Ahrengart 1994; Benum 1994; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Michos 2001; Mott 1993) included subtrochanteric fractures as well as trochanteric fractures. Where recorded, the mean ages of trial participants ranged between 73 and 84 years and the proportion of male patients varied from 15% to 40% in individual studies.

Intramedullary hip screw (IMHS) versus SHS

The five trials (Baumgaertner 1998; Hardy 1998: Harrington 2002; Hoffmann 1999, Mehdi 2000) comparing the IMHS with the SHS involved a total of 623 people with 627 stable or unstable trochanteric fractures. The mean ages of the participants of individual trials were between 76 and 83 years and, where reported, proportion of males varied from 20% to 34%.

Full published reports were available for four trials (Baumgaertner 1998; Hardy 1998; Harrington 2002, Hoffmann 1999). A limited translation from German was obtained for Hoffmann 1999. A conference abstract (Hardy 1999) presenting the results of 160 people at 18 months follow up is available for Hardy 1998 but, pending clarification of the limited results presented in the abstract, so far we have not included the results for the extra 60 participants. Mehdi 2000 has only been reported as a conference abstract, however unpublished material for this trial indicate that the limited results in the abstract applied to the whole trial population.

Proximal femoral nail

Three trials (Pajarinen 2005; Papasimos 2005; Saudan 2002), compared the proximal femoral nail (PFN) with the SHS in 394 people with trochanteric hip fractures. The mean ages of participants of the three trials ranged between 81 and 83 years, and the proportion of males varied between 22% to 39%.

Targon PF (proximal femoral) nail

One trial (Giraud 2005) compared a Targon PF intramedullary nail with the SHS in 60 people with stable or unstable trochanteric fractures. The mean age of trial participants was 82 years and 23% were male.

Mini-invasive static intramedullary nail

One trial (Dujardin 2001) compared an experimental mini-invasive static intramedullary nail with the SHS in 60 people with stable or unstable trochanteric fractures. The mean age of trial participants was 83.5 years and 20% were male.

Kuntscher-Y nail

One trial (Davis 1988) compared the Kuntscher-Y nail with the SHS. The 230 participants with intertrochanteric fractures had a mean age of 81 years and 17% were male.

Intramedullary nails (various types) versus Medoff sliding plate

One trial (Miedel 2005) compared the Gamma nail with a Medoff sliding plate in 217 people with either an unstable trochanteric fracture (189 cases) or a subtrochanteric fracture (28 cases). The mean age of participants was 84 years and 19% were male. Another trial (Ekstrom 2007) compared the proximal femoral nail (PFN) with a Medoff sliding plate in 203 people (out of 210 recruited) with either an unstable trochanteric fracture (172 cases) or a subtrochanteric fracture (31 cases). The mean age of participants was 82 years and 24% were male.

Intramedullary nails (various types) versus fixed (static) extramedullary plates

One trial (Pelet 2001) compared the Gamma nail with a blade plate in 26 people (mean age 71 years; 35% male) with a comminuted trochanteric fracture, classified as Kyle type IV. These fracture patterns approximate to those of type 31A3 fractures in the AO classification of fractures with reversed fracture pattern or transverse fracture lines at the level of the lesser trochanter (Muller 1991). Sadowski 2002 compared the PFN with the dynamic condylar screw in 39 people (mean age 79 years; 31% male) with type 31A3 fractures.

Risk of bias in included studies

The results of the methodological assessment for individual trials are given below. (Note that Papasimos 2005 appears in two categories.) Further details of allocation concealment and randomisation (item 1), surgeon's experience (item 5) and assessor blinding (item 8) are also presented.

Table of the individual methodological quality scores (*see* Table 2 for criteria)

1 2 3 4 5 6 7 8 9 10 11 Trial name

Gamma nail versus sliding hip screw

2 1 1 1 1 1 1 1 1 1 1 Adams 2001
2 1 0 1 1 0 0 0 1 0 1 Ahrengart 1994
1 0 0 1 0 0 0 0 1 0 0 Benum 1994
1 1 0 1 1 0 0 0 1 0 0 Bridle 1991
0 1 0 1 0 0 0 0 0 1 0 Butt 1995
0 1 0 1 0 0 1 0 1 1 0 Goldhagen 1994
0 0 0 0 0 1 0 0 0 0 0 Guyer 1991
0 1 0 1 0 0 0 0 1 1 0 Haynes 1996
3 1 1 1 0 1 1 1 1 1 1 Hoffman 1996
2 1 1 1 1 0 1 0 1 1 1 Kukla 1997
1 0 0 1 0 0 0 0 1 0 0 Kuwabara 1998
0 0 0 0 0 0 0 0 1 1 1 Leung 1992
0 1 0 1 0 0 0 0 1 0 0 Marques Lopez 2002

1 0 0 0 0 0 0 0 0 0 0 Michos 2001
2 1 0 0 0 0 1 0 0 0 1 Mott 1993
3 1 0 1 0 0 1 0 0 0 1 O'Brien 1995
3 1 1 1 0 1 0 0 1 0 1 Ovesen 2006
1 0 0 0 0 0 0 0 1 0 0 Pahlpatz 1993
1 1 0 1 0 1 0 0 1 0 0 Papasimos 2005
0 1 1 1 0 0 1 0 0 1 0 Park 1998
1 0 0 1 1 0 0 0 1 0 0 Radford 1993
2 1 1 0 0 1 1 0 1 1 0 Utrilla 2005

Intramedullary hip screw (IMHS) versus sliding hip screw
3 1 0 0 0 1 1 0 1 1 1 Baumgaertner 1998
0 1 1 1 0 1 1 1 1 1 0 Hardy 1998
2 1 0 1 0 1 1 1 1 1 1 Harrington 2002
3 1 1 1 0 1 1 0 0 1 0 Hoffmann 1999
2 0 0 0 0 0 0 0 1 0 1 Mehdi 2000

Proximal femoral nail (PFN) versus sliding hip screw
3 1 1 1 1 1 1 0 0 0 1 Pajarinen 2005
1 1 0 1 0 1 0 0 1 0 0 Papasimos 2005
2 1 1 1 1 1 1 0 1 1 1 Saudan 2002
Targon PF (proximal femoral) nail versus sliding hip screw
2 1 1 1 0 0 1 0 0 0 1 Giraud 2005
Mini-invasive static intramedullary nail versus sliding hip screw
1 1 0 1 1 1 1 0 1 0 0 Dujardin 2001
Kuntscher-Y nail versus sliding hip screw
3 1 0 1 0 0 1 0 0 1 1 Davis 1988
Intramedullary nails (various types) versus Medoff sliding plate
2 1 0 1 0 1 1 0 1 0 0 Ekstrom 2007
2 1 1 1 0 1 1 0 1 1 0 Miedel 2005
Intramedullary nails (various types) versus fixed (static) extramedullary plates
2 1 1 1 0 1 1 0 1 1 1 Pelet 2001
2 1 1 1 1 1 1 0 1 1 1 Sadowski 2002

Sixteen trials randomised using envelopes; these were described as sealed in 14 trials (Adams 2001; Ahrengart 1994; Baumgaertner 1998; Davis 1988; Ekstrom 2007; Harrington 2002; Hoffman 1996; Hoffmann 1999; Kukla 1997; Mehdi 2000; Miedel 2005; O'Brien 1995; Ovesen 2006; Pajarinen 2005; Utrilla 2005) and mixed in Benum 1994. Seven trials (Baumgaertner 1998; Davis 1988; Hoffman 1996; Hoffmann 1999; O'Brien 1995; Ovesen 2006; Pajarinen 2005) indicated that the randomisation was blinded. Blinded randomisation was also claimed for Pelet 2001, which used the drawing of lots, but safeguards were not described. Computer generated randomised numbers were used for Mott 1993, Sadowski 2002 and Saudan 2002. Giraud 2005 used a random numbers table. A further seven trials were quasi-randomised in which the treatment allocation was inadequately concealed using either alternating patient admission (Guyer 1991; Leung 1992), medical record numbers (Goldhagen 1994; Hardy 1998; Marques Lopez 2002; Park 1998), or an even or odd week of admission (Butt 1995). Though Haynes 1996 used randomisation cards, allocation concealment was deemed unlikely as the imbalance in the treatment group numbers was attributed to surgeons withdrawing a patient from the trial when they considered themselves unfamiliar with the Gamma nail. The remaining trials did not specify their method of randomisation.

Brief details of surgical experience (item 5) as reported for individual trials are given in the 'Characteristics of included studies' table. For several trials, surgeons may have been more experienced with the SHS than the newer implant (the intramedullary nail). This disparity of experience was certainly true for Baumgaertner 1998 and Harrington 2002 where the participating surgeons had experience with using sliding hip screws but not specifically with the IMHS despite being familiar with the techniques involved. Conversely in Leung 1992, most of the Gamma nail operations were performed by one senior surgeon with a special interest in intramedullary nailing whilst the SHS operations were performed by a variety of often less experienced surgeons. Similarly in Marques Lopez 2002, the majority of Gamma nail operations were performed by specialists and conversely the majority of SHS operations were done by junior or senior residents. In addition, surgeons were more experienced with the Gamma nail than with the blade plate in Pelet 2001.

Only four trials (Adams 2001; Harrington 2002; Hardy 1998; Hoffman 1996) included blinded assessment of some outcomes (item 8).

Effects of interventions

These are presented by the type of cephalocondylic nail being compared with the extramedullary plate device (sliding hip screw or the Medoff plate) and, for two studies, the dynamic condylar screw and the 90 degree blade plate. The outcome measures listed earlier were sought for all studies and, where available, results are summarised in the analyses. Reported outcomes are also listed in the 'Characteristics of included studies' table. The key pooled outcomes for four of the femoral nails (Gamma, IMHS, PFN and the Targon PF) versus the sliding hip screw are given first, followed by the results for each type of nail. The experimental nature, including the lack of commercial availability, of the mini-invasive intramedullary nail should be noted when viewing the results of this trial and was the reason for not including it at present in the pooled femoral nail analysis. The results for the Kuntscher-Y nail were also not pooled with the other nails because this earlier version of a cephalocondylic nail does not have the capacity for distal locking.

The included trials generally used similar outcome measures with regard to surgical fixation failure and operative details. Wound infection was usually more difficult to quantify and it was not possible to differentiate between superficial and deep wound infection for many of the trials. Mortality was taken as that which occurred within the follow-up period for each study. The outcome measures of residual pain, change in mobility and function are more difficult to quantify and were recorded in fewer trials. Moreover, because no standardised assessment was used for all trials, only a limited evaluation was possible for these outcomes. Data from each trial which could be pooled are presented graphically. As reported in Methods, we performed sensitivity analyses to explore the effects of our choice for denominators when these were not clearly stated in trial reports. No significant changes in the pooled results were encountered (e.g. *see* Analyses 2.8 and 2.10).

Four types of femoral nails (Gamma, IMHS, PFN and Targon PF) versus the sliding hip screw (SHS)

To avoid double counting of the participants of the SHS group, the combined data for the Gamma nail and PFN groups of Papasimos 2005 are presented in a separate sub-category (5 in Analyses 1.2 to 1.7). Thus the results for Papasimos 2005 do not appear in the Gamma nail (sub-category 1) or PFN (sub-category 3) analyses. The pooled results for these four types of nail demonstrate a significantly lower incidence of the complications for operative fracture of the femur (*see* Analysis 1.2: 35/1804 versus 6/1799; RR 3.25, 95% CI 1.74 to 6.08), later fracture of the femur (*see* Analysis 1.3: 39/1683 versus 2/1645; RR 5.22, 95% CI 2.56 to 10.64) and overall technical complications of fixation (*see* Analysis 1.6: 150/1871 versus 74/1861; RR 1.97, 95% CI 1.51 to 2.58) in favour of the SHS. There was remarkable homogeneity in the results of the trials within and between the separate categories for these outcomes. These complications contribute to the significantly greater reoperation rate for femoral nails (*see* Analysis 1.7: 105/1698 versus 64/1690; RR 1.58, 95% CI 1.17 to 2.12).
Pooled results for cut-out (*see* Analysis 1.4), non union (*see* Analysis 1.5), deep wound infection (*see* Analysis 1.8) and mortality (*see* Analysis 1.9) show no difference between the two types of implant, and again show uniformity. Far fewer data were available for the three other outcomes (length of surgery, pain and non return to previous residence or dead) presented graphically (*see* Analyses 1.1, 1.10 and 1.11 respectively); none showed a statistically significant difference between the two groups. The heterogeneity in the length of surgery results continues to be striking.

Gamma nail versus the sliding hip screw (SHS)

Data for 3080 people were available from the 22 randomised controlled trials (Adams 2001; Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Hoffman 1996; Kukla 1997; Kuwabara 1998; Leung 1992; Marques Lopez 2002; Michos 2001; Mott 1993; O'Brien 1995; Ovesen 2006; Pahlpatz 1993; Papasimos 2005; Park 1998; Radford 1993; Utrilla 2005) comparing the Gamma nail with the SHS. Eight trials (Ahrengart 1994; Benum 1994; Butt 1995; Goldhagen 1994; Guyer 1991; Haynes 1996; Michos 2001; Mott 1993) included subtrochanteric fractures as well as trochanteric fractures. It is important to note that data are unavailable and may be lost for over 1000 trial participants from either those trials apparently completed but for which complete trial data have neither been published nor made available (Ahrengart 1994; Benum 1994; Hogh 1992) or trials which may not have been completed (Pahlpatz 1993; Prinz 1996). Different versions of the Gamma nail were used: the early studies used the 'Gamma 1' nail and the later studies used the trochanteric Gamma nail (Ovesen 2006; Papasimos 2005; Utrilla 2005). The results of all these trials have been pooled in this review. Inspection of the analyses for various fracture fixation complications and reoperation shows no indication of a marked difference in results in the two groups of trials; overall, there was no statistical heterogeneity in any of the pooled results (I^2 = 0% in all analyses). We subgrouped these trials by Gamma nail design for reoperation (*see* Analysis 2.28), and found the results of the two groups were not statistically significantly different from each other (test for interaction: two tail z-test = 0.347).

Operative details

Most trials reporting length of surgery indicated that there was no difference or no significant difference between the two implants for this outcome (Bridle 1991; Butt 1995; Goldhagen 1994; Hoffman 1996; Leung 1992; Kukla 1997; Kuwabara 1998; Marques Lopez 2002; Mott 1993; Radford 1993). Five trials, however, found increased operating times for the Gamma nail (Ahrengart 1994; Benum 1994; Haynes 1996; O'Brien 1995; Ovesen 2006). Conversely, Adams 2001 and Park 1998 reported a significant reduction in operating times for the Gamma nail. This probably applied also to Papasimos 2005. Data for Leung 1992 which also showed a significant reduction in operating times for the Gamma nail were removed from the analysis as they were inconsistent with the statements in the text. In two studies (Ahrengart 1994; Goldhagen 1994) the results were split up by intertrochanteric, where the mean operation time was greater in the Gamma nail group, and subtrochanteric fractures, where it was less. In explanation, Goldhagen 1994 referred to a significant learning curve for the Gamma nail in contrast to the extensive experience with the SHS. It is unclear whether this effect of fracture type applies generally but, irrespective of this observation, the meta-analysis of length of surgery is limited because of the lack of data. Results of the six trials (*see* Analysis 2.1) providing data for length of surgery show considerable heterogeneity (chi^2 = 34.80, $P < 0.00001$; I^2 = 85.6%). It is also likely that the individual patient data for this outcome, and indeed for other continuous outcome measures given below, do not conform to a normal distribution. Although the data from Kukla 1997 have been presented, Kukla 1997 considered the distribution pattern warranted a log transformation before analysis and then found no statistically significant difference in the results of the two groups.
There were no significant differences for blood loss or for transfusion requirements reported in 12 studies (Adams 2001; Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Guyer 1991; Kukla 1997; Kuwabara 1998; Mott 1993; O'Brien 1995; Papasimos 2005). Others (Haynes 1996; Leung 1992; Park 1998; Radford 1993) found a significantly lower blood loss for

the Gamma nail, as did Fornander (Fornander 1994) in the two-centre analysis for Ahrengart 1994. Michos 2001 also reported a lower blood loss for the Gamma nail group but did not indicate if this was a statistically significant result. One study (Hoffman 1996) found an increased blood loss for the Gamma nail. Whilst data from five studies (Adams 2001; Kukla 1997; Leung 1992; O'Brien 1995; Ovesen 2006) are shown in Analysis 2.2, the lack of available data from other trials means that no firm conclusion can be drawn. The significant heterogeneity of the pooled results ($chi^2 = 8.31$, $P = 0.08$; $I^2 = 51.9\%$) can be attributed to the inclusion of the more extreme results of Leung 1992; removal of these reveals the more homogenous results of the other three trials ($chi^2 = 0.71$, $P = 0.87$; analysis not shown). The three trials (Adams 2001; Ovesen 2006; Utrilla 2005) reporting the numbers of people receiving blood transfusion had significantly heterogeneous results ($chi^2 = 9.77$, $P = 0.008$); when pooled these showed no significant difference between the two groups (*see* Analysis 2.3).

Seven studies reported radiographic screening times. Goldhagen 1994, Marques Lopez 2002 and Papasimos 2005 reported that the increased time for the Gamma nail did not reach statistical significance, whereas Leung 1992 and Utrilla 2005 reported a significant decrease for the Gamma nail and two studies (Hoffman 1996; O'Brien 1995) showed a significant increase. Again, drawing conclusions from the pooling of the limited data available is not possible (*see* Analysis 2.4) and not done in view of the very major heterogeneity ($chi^2 = 130.84$, $P < 0.00001$; $I^2 = 97.7\%$), with Leung 1992 and Utrilla 2005 reporting a different effect direction than the other two studies. While we conjecture that the results for Leung 1992 may reflect the disparate experience of the surgeons performing the two operations in this trial, this probably does not apply to Utrilla 2005.

Fracture fixation complications

The outcomes shown are direct complications regarding the implant. Pooled data from 18 trials shows the incidence of operative fracture of the femoral diaphysis is significantly increased when the Gamma nail is used (*see* Analyses 2.5: 27/1351 versus 6/1379; RR 3.02, 95% CI 1.51 to 6.03). No trend in the incidence of this outcome was observed when the trials were arranged by date of publication. When the trials were subgrouped (see Analysis 2.6) according to the trial report of surgeon's experience with the devices used, the test of interaction showed no statistically significant difference (two tail z-test = 0.662) in results of the trials where the surgeons were reported to be experienced with the devices and those trials where either no information was provided or a lack of prior experience was reported.

Subsequent fracture of the femur around the implant occurred in 35 cases of Gamma nailing but in only two cases of SHS fixation (*see* Analysis 2.7: 35/1332 versus 2/1341; RR 5.23, 95% CI 2.46 to 11.14).

Pooled data for cut-out of the implant from the femoral head from 20 trials showed no difference between implants (*see* Analysis 2.8: 46/1334 versus 41/1361; RR 1.15, 95% CI 0.76 to 1.72). Analysis 2.9 shows the trials subgrouped by reported experience of surgeons with the devices: there was no statistical significant difference between the two subgroups (test for interaction: two tail z-test = 0.745). The next analysis (2.10) shows the very similar pooled results when the overall denominators are applied. Where reported, there was also no difference in the incidence of non-union (or non healed fractures) (*see* Analysis 2.11), or time to union or for fracture healing (no analyses shown).

The outcome 'all technical complications of fixation' comprised the complications detailed above and any additional major complications of fracture healing such as detachment of the plate from the femur, re-fracture proximal to the implant, non-union of the fracture or avascular necrosis. Data for this outcome were available for all studies except Pahlpatz 1993. This result confirmed the greater risk of fracture healing complications for the Gamma nail with overall figures of 118/1420 for the Gamma nail versus 60/1451 for the sliding hip screw (*see* Analysis 2.13: RR 2.00, 95% CI 1.48 to 2.69; 21 trials).

Fracture of the femur was the main reason for a significantly increased reoperation rate for the Gamma nail (*see* Analysis 2.14, pooled results from 18 studies: 86/1320 versus 52/1345; RR 1.66, 95% CI 1.19 to 2.31).

Wound infection (presented as either any infection or deep wound infection) and, when reported, wound haematoma showed no significant difference between the two implants as shown in Analysis 2.16.

Post-operative complications

From the data available, there is not a statistically significant difference between implants for the complications of pneumonia (nine studies: *see* Analysis 2.17), pressure sores (five studies: *see* Analysis 2.18), thromboembolic complications (12 studies: *see* Analysis 2.19), and any medical complications other than wound infection or haematoma (six studies: *see* Analysis 2.20).

With the exception of Michos 2001, all studies reporting hospital stay stated that there were no differences or no significant differences in this outcome between the two implants (Ahrengart 1994; Benum 1994; Bridle 1991; Butt 1995; Goldhagen 1994; Haynes 1996; Hoffman 1996; Kukla 1997; Leung 1992; Marques Lopez 2002; O'Brien 1995; Ovesen 2006; Papasimos 2005; Radford 1993). This is supported by the limited data available (Hoffman 1996; Kukla 1997; Leung 1992; O'Brien 1995; Ovesen 2006) for pooling (*see* Analysis 2.21). Michos 2001 reported a shorter hospitalisation time for the Gamma nail group (mean value: 12 versus 14.5 days) but did not indicate if their finding was statistically significant.

Anatomical restoration (*see* Analysis 2.22)

Six studies reported on limb shortening. Ahrengart 1994 and Hoffman 1996 reported that there was no overall difference, and two studies (Kukla 1997; Leung 1992) reported the same for the numbers of people with over two centimetres of shortening. Guyer 1991 reported the numbers of patients with more than one centimetre of shortening. The results in favour of the Gamma nail group are dominated by the results of the latter trial in the pooled results of data from just three of the five trials. Utrilla 2005 reported no statistically significant difference between the two groups (mean shortening: 4.5 mm versus 3.2 mm; P = 0.35).

Data for varus deformity (expressed as angulation greater than 10 degrees, malunion or deformity) provided by five studies reporting this outcome, showed no statistically significant difference between the two groups.

External rotation deformity was reported by two studies (Kuwabara 1998; Leung 1992), which found no difference between the two groups.

Final outcome measures

Mortality data measured from between 3 and 12 months were presented in 16 studies. No data were available in Benum 1994 who reported a 16% mortality at six months with no difference between the two groups, nor for Kuwabara 1998 and Park 1998 which did not refer to this outcome. Michos 2001 and Mott 1993 only reported on peri-operative mortality. Papasimos 2005 only reported on hospital mortality (2 versus 1). The values for individual studies which seemed independent of the length of follow up ranged from 4% (Goldhagen 1994; Ovesen 2006) to 34% (Bridle 1991; Marques Lopez 2002). Analysis 2.23 clearly shows no significant difference in mortality between the two implants (209/1136 versus 228/1170; RR 0.95, 95% CI 0.81 to 1.12). The potential effect of selection bias (testing a post-hoc hypothesis that there would be a tendency to place more frail and ill patients in the SHS group) was investigated by subgrouping the data according to allocation concealment. Analyses based on Cochrane grades (A, B or C) have been presented (*see* Analysis: 2.24). While there was a trend to a higher mortality in the trials with adequate allocation concealment, a test of interaction between these trials and those with no concealment of allocation was not statistically significant (two tail z-test = 0.071). Thus, more evidence is required to prove the selection bias proposed above.

Of the seven studies reporting post-operative pain (Ahrengart 1994; Goldhagen 1994; Guyer 1991; Hoffman 1996; Leung 1992; O'Brien 1995; Utrilla 2005), only Ahrengart 1994 reported a significant difference between the two implants. In an abstract report including participants at all five centres in Ahrengart 1994, 19% of Gamma nail group participants compared with 6% of SHS group participants complained of pain at the top of the greater trochanter (P value reported as < 0.001). Pooling of pain outcome data is hampered by the different methods of assessing residual pain performed at different time intervals from injury. The numbers at final follow up shown in the analyses were reported as persisting lateral hip pain (Ahrengart 1994: two centre data), pain on walking (Guyer 1991), pain in hip and pain in thigh (Leung 1992), thigh pain (Utrilla 2005) and unresolved pain in the subgroup of patients with intertrochanteric fractures (Hoffman 1996). When pooled, these data showed no significant difference between the two implants in patients with residual pain (*see* Analysis 2.25).

The return to pre-fracture residential status, expressed in various ways such as transfer to long-term care and stay in institutions, as well as return to pre-fracture residence, was stated or implied as being no different in nine trials (Ahrengart 1994 (two centre data); Adams 2001; Benum 1994; Bridle 1991; Goldhagen 1994; Hoffman 1996; O'Brien 1995; Pahlpatz 1993; Radford 1993). Of the four trials providing data for pooling, Ahrengart 1994 reported the numbers discharged to their pre-fracture residence for two centres, whereas the results for the other three applied to residential status at six months. Data for Haynes 1996 were deduced from pre-fracture and six-month follow-up residence (home or institutional). Kukla 1997 reported that eight out of 89 patients in the study were in specialised nursing homes at the end of the study, but did not split by treatment group. Neither the analysis for non-return to previous residence for survivors nor that for overall non-return including deaths showed a significant difference between the two implants (*see* Analysis 2.26).

Measures of mobility varied between studies and were broadly based on the numbers able to walk independently, the numbers requiring walking aids and those who were bed or chair bound. Some studies (Hoffman 1996; Marques Lopez 2002) further refined this by ranking or scoring systems and recorded the difference in levels of attainment between pre-fracture and post-fracture mobility. Utrilla 2005 also presented a walking ability score. Pre-fracture mobility was probably assessed in all studies and when reported, was said to be comparable between implants groups with the exception of Hoffman 1996 where the pre-fracture status was noted as being better in the Ambi (SHS) group. Eleven studies (Ahrengart 1994; Benum 1994; Bridle 1991; Goldhagen 1994; Kukla 1997; Kuwabara 1998; Marques Lopez 2002; O'Brien 1995; Ovesen 2006; Radford 1993; Utrilla 2005) found no difference in post-operative mobility or changes in mobility. Hoffman 1996 was the only study to use blinded assessment of mobility and reported better mobility with the SHS in the early stages, but no difference at 12 weeks. Although loss of mobility data were presented by a histogram in Bridle 1991, these differed from results given in text. The only data available for pooling were the numbers of trial participants who could walk without, or with only limited, aids (or, as presented in Analysis 2.27, the numbers with impaired walking) from seven studies (Adams 2001; Ahrengart 1994 (two centre data); Guyer 1991; Kukla 1997; Leung 1992; Ovesen 2006; Park 1998), and a reduction in numbers attaining pre-fracture mobility status (independent or aided) in Haynes 1996. This provides an incomplete picture of mobility and no conclusion can be drawn save the general impression that there is no difference in mobility between the two implants.

Adams 2001 reported on the Harris hip score for the survivors at one year, for which there was no difference between the groups. Papasimos 2005 reported a higher Salvati and Wilson score (based on pain, walking, muscle power and motion, function; 0: worst to 40: best) at one year for the nail group (mean: 33 versus 27; P value not reported).

None of the included trials reported costs or attempted an economic evaluation.

Intramedullary hip screw (IMHS) versus the sliding hip screw (SHS)

Five randomised trials (Baumgaertner 1998; Hardy 1998; Harrington 2002; Hoffmann 1999; Mehdi 2000) compared the IMHS with the SHS in 623 people with trochanteric fractures. Very limited results were available for Mehdi 2000, which was only reported in a conference abstract.

Operative details

Mean operating times in the IMHS group relative to those for SHS group were less in two trials (Baumgaertner 1998; Hoffmann 1999), but greater in the other three. Pooled results from three trials (Baumgaertner 1998; Hardy 1998; Harrington 2002) show highly significant heterogeneity ($P = 0.001$; $I^2 = 85.1\%$), and a statistically non significant result when the random-effects model is applied (*see* Analysis 3.1). The variation in the results may in part reflect different definitions of this outcome. For instance, Hoffmann 1999 reported the IMHS took on average six minutes less operative time (72 versus 78 minutes) but the total anaesthetic time was on average eight minutes longer for the IMHS (123 versus 115 minutes); neither of these differences were reported as being statistically significant.

Pooled data from two studies (Baumgaertner 1998; Hardy 1998) for operative blood loss were homogeneous and showed a statistically significant reduction (*see* Analysis 3.2: weighted mean difference -62.42 ml, 95% CI -98.56 to -26.28 ml) in the IMHS group. Hoffmann 1999 and Mehdi 2000 also reported lower mean values for the IMHS group (380 ml versus 400 ml; 247 ml versus 270 ml); the difference between the IMHS and SHS groups was indicated as not being statistically significant for either trial. The mean number of units of red cells transfused was greater in the IMHS group in Baumgaertner 1998, and less in Hardy 1998; pooled data using the random-effects model showed no significant difference between the two groups (*see* Analysis 3.3). Harrington 2002 reported no statistically significant difference between groups in the proportion of patients receiving transfusion (*see* Analysis 3.4: 18/50 versus 22/52; RR 0.85, 95% CI 0.52 to 1.39). Hoffmann 1999 reported a mean difference in pre and post-operative haemoglobin of 1.95 gm/dl for the IMHS and 2.20 gm/dl for the SHS; the difference between the two groups was reported to be not statistically significant.

Pooled data from two trials (Baumgaertner 1998; Harrington 2002) showed the mean radiographic screening time was about one minute longer in the IMHS group (*see* Analysis 3.5: weighted mean difference 1.15 minutes, 95% CI 0.83 to 1.47 minutes). Screening time was slightly greater for the IHMS group in Hoffmann 1999, but the difference was reported not to be statistically significant (5.7 versus 5.4 minutes).

Fracture fixation complications

Pooled data as available for operative fracture of the femur, later fracture of the femur, cut-out, non-union, plate detachment and total fixation failure rate are shown in Analysis 3.6. Although twice as many people with the IMHS had fracture fixation complications, including all of the intra-operative and later femur fractures, the difference between the two groups did not reach statistical significance (18/223 versus 9/224; RR 2.02, 95% CI 0.93 to 4.39). Baumgaertner 1998 also reported an incorrectly assembled IMHS as well as two cases of delayed union, one in each group. Hoffmann 1999 reported that two cases in the SHS had loss of fracture reduction requiring re-fixation. These were the only reoperations within this study and the complication of cut-out was not mentioned. Mehdi 2000 referred to one peri-operative complication in the IMHS group and three in the SHS group that were “directly related to the procedure” but did not specify what these were. Complete data for reoperation were unavailable for Baumgaertner 1998 but there was mention of two SHS group participants who required removal of painful hardware. Similar numbers of people (3 versus 4) had reoperations in Hardy 1998, mostly to remove painful hardware (3 versus 2). Neither Harrington 2002 nor Mehdi 2000 reported reoperations.

Of the three trials (Hardy 1998; Hoffman 1996; Mehdi 2000) reporting on wound infection, the only cases occurred in Mehdi 2000 (*see* Analysis 3.7). Antibiotic prophylaxis was used in all trials except Mehdi 2000. Five wound haematomas, all in IMHS patients, were reported for the trials of Baumgaertner 1998 and Hardy 1998. Hoffmann 1999 reported eight wound haematomas requiring puncture, three in the IMHS group and five in the SHS group. Pooled data for haematoma showed no statistically significant difference between the two groups (*see* Analysis 3.7: 8/173 versus 5/172; RR 1.47, 95% CI 0.54 to 4.02).

Post-operative complications

These outcomes were not reported in Harrington 2002 and Mehdi 2000. Baumgaertner 1998 reported similar numbers of people in the two groups who had a major medical complication but did not provide separate data for specific medical complications. Both Hardy 1998 and Hoffmann 1999 also observed similar numbers of complications, with data for pneumonia, cardiac failure, urinary tract infection, and thromboembolic complications, in each group. Separate and combined outcome data presented in Analysis 3.8 are consistent with these reports. There was no statistically significant difference in the length of hospital stay between the two groups in the three trials reporting this outcome (Baumgaertner 1998; Harrington 2002; Hoffmann 1999): data were only available from two trials (*see* Analysis 3.9).

Anatomical restoration

These outcomes were only reported in two trials (Hardy 1998; Hoffmann 1999). Hardy 1998 reported that, for a subgroup of 64 patients who underwent radiographic evaluation at fracture consolidation, there was a significantly reduced mean shortening of the fractured leg in the IMHS group (*see* Analysis 3.10: mean difference -0.70 cm, 95% CI -1.13 to -0.27 cm). Hoffmann 1999 reported that shortening of more than one centimetre occurred in one person of each group. This study also stated that one IMHS group participant had a "relevant" rotational deformity of the limb.

Final outcome measures (see Analysis 3.11)

Mortality at one year (Baumgaertner 1998; Hardy 1998; Harrington 2002) and around four months (Hoffmann 1999) showed no significant difference between the two groups (54/221 versus 60/222; RR 0.91, 95% CI 0.67 to 1.24). In Baumgaertner 1998, both people with two fractures at different times who had been allocated different implants for their second fracture died. These people have been only counted once in the analysis.

Pain data at final follow up were given for hip and mid-thigh pain for survivors at one year in Hardy 1998, and at final follow up between four and 54 months for 105 trial participants (17 people who died by three months, seven people with hardware failure and the two people with different implants were excluded) in Baumgaertner 1998. Hoffmann 1999 reported on those with pain on walking at the final follow up of a mean of 3.7 months. Pooled results from these three trials showed no statistically significant difference between the two groups (*see* Analysis 3.11: 38/132 versus 32/131; RR 1.17, 95% CI 0.79 to 1.75). Harrington 2002 and Mehdi 2000 did not report pain.

Data for failure to return to pre-fracture residential status were available for three trials (Baumgaertner 1998; Harrington 2002; Hoffmann 1999). Pooled results from these three trials showed no difference between the two groups in survivors failing to return home (36/127 versus 32/129; RR 1.16, 95% CI 0.78 to 1.73). A similar result emerges for the combined outcome of failure to return home and death (*see* Analysis 3.11). Hardy 1998 included residential status in an assessment of social functioning mostly based on the patient's level of independence. Similar numbers of people in both groups (10/26 versus 12/24) had dropped at least one level of social function in results for the subgroup of 50 people who had not returned to their pre-fracture nursing home.

Baumgaertner 1998 reported on those returning to pre-fracture mobility with no difference between groups (*see* Analysis 3.11). At around four months, Hoffmann 1999 found no difference between the two groups in the use of walking aids, or in the numbers unable to walk for one hour, with no statistically significant difference between the two groups (16/45 versus 19/43; RR 0.80, 95% CI 0.48 to 1.35). However, before discharge most (51/56) of the IMHS patients were fully weight bearing whereas under half of the SHS patients were (22/54). Blindly assessed mobility scores and use of assistive devices were reported in Hardy 1998. Mobility scores for the IMHS group were significantly better at one and three months, and although the differences between mean mobility scores did not achieve statistical significance at 6 or 12 months, walking ability outside the home remained better in the IMHS group. Hardy 1998 noted that while this could relate to the lower amount of leg shortening in the IMHS group, the enhanced mobility had not had a major impact on other functional outcomes. Hoffmann 1999 also used the Merle d'Aubigne score with no significant difference found between groups; an unsatisfactory score was attained by two IMHS patients and three SHS patients.

Mehdi 2000 considered that their study showed that functional outcome of the IMHS is as good as the SHS but provided no supporting data.

Baumgaertner 1998 provided data for hospital charges which showed that on average those for the IMHS group were $6000 (USA) more. This difference was reported not to be statistically significant. It was unclear how the hospital charges were derived.

Proximal femoral nail (PFN) versus sliding hip screw (SHS)

This comparison was evaluated by three trials (Pajarinen 2005; Papasimos 2005; Saudan 2002) in 394 people with trochanteric hip fractures.

Operative details

Both Pajarinen 2005 and Papasimos 2005 reported a statistically significantly higher median length of surgery for the PFN group (respectively: 55 versus 45 minutes, reported P = 0.011; 71 versus 59 minutes, reported P < 0.05), whilst Saudan 2002 found no difference between the two groups (*see* Analysis 4.1: mean difference -1.00 minute, 95% CI -9.14 to 7.14 minutes). Blood losses and transfusion were similar for both groups of Pajarinen 2005 (*see* Analysis 4.2). Papasimos 2005 reported no statistically significant difference between groups for operative blood loss (265 ml versus 282.4 ml; reported P > 0.05). Though fewer people received transfusion in the PFN group of Saudan 2002 (*see* Analysis 4.3: 55/100 versus 72/106; RR 0.81, 95% CI 0.65 to 1.01), there was no difference between the two groups in the mean number of units of blood transfused (1.5 versus 1.7 units). Saudan 2002 found the mean radiographic screening time was about one minute longer in the PFN group (*see* Analysis 4.4), while Papasimos 2005 found no significant difference (0.26 versus 0.21 minutes; reported P > 0.05).

Fracture fixation complications (*see* Analysis 4.5)

There were no intra-operative or later fractures of the femur. Similar numbers of cut-out occurred in the two groups (*see* Analysis 4.5) and there was one case of non-union in the SHS group of Papasimos 2005. The mean times to fracture "consolidation" were similar in the two groups: Papasimos 2005 (3.2 versus 3.4 months) and Saudan 2002 (4.6 versus 4.8 months). There was a statistically non-significant tendency for an increased fixation failure rate (11/194 versus 6/200; RR 1.86, 95% CI 0.71 to 4.85) and reoperation rate (13/194 versus 7/200; RR 1.90, 95% CI 0.78 to 4.62) for the PFN. No details of the reoperations were given in Pajarinen 2005. In Papasimos 2005, re-operation entailed implant removal in 5 cases (4 versus 1), a hip prothesis in two cases (1 versus 1) and replacement by a Gamma nail and bone graft for the single case of non-union in the SHS group. Those of Saudan 2002 involved implant removal and debridement in four cases (3 versus 1) and a hip prosthesis in the other four cases (3 versus 1).

There were no significant differences in the reported incidences of wound infections and haematomas (*see* Analysis 4.6). Papasimos 2005 also reported that one person in the SHS group had delayed wound healing, and Saudan 2002 reported that wound healing complications occurred in similar numbers in the two groups (10 versus 11).

Post-operative complications (*see* Analysis 4.7)

As shown in Analysis 4.7, there were no differences between the two groups in the incidence of pneumonia, pressure sores, deep vein thrombosis or pulmonary embolism. Over a quarter of participants had an urinary tract infection in Sadowski 2002. Although, there were more people in the PFN group of Saudan 2002 with urinary tract infection (34/100 versus 23/106; RR 1.57, 95% CI 1.00 to 2.47), there was no statistically significant difference in the overall numbers of people with any medical complication (52/100 versus 49/106; RR 1.12, 95% CI 0.85 to 1.49) in this trial. There were no statistically significant differences between the two devices in the mean lengths of hospital stay for all three trials (*see* Analysis 4.8; for Papasimos 2005, the mean times were 8.8 versus 9.9 days, reported P > 0.05).

Anatomical restoration

Clinical measures such as limb shortening were not reported by any of the trials. Papasimos 2005 reported two cases of malrotation and two cases of varus or valgus deformity in each of the nail and SHS groups. Based on X-ray results, Pajarinen 2005 reported no difference in the femoral neck-shaft angles or the mean shortening of the femoral shaft (2.5 mm versus 4.7 mm; reported P = 0.081), but greater mean shortening of the femoral neck for the SHS cases (1.3 mm versus 6.1 mm; reported P = 0.003).

Final outcome measures (*see* Analysis 4.9)

Papasimos 2005 only reported on hospital mortality, with one in each group. Pajarinen 2005 reported morality at four months and Saudan 2002 at one year with no statistically significant difference between the two groups in either trial. Neither Pajarinen 2005 nor Saudan 2002 found a statistically significant difference in residential status at final follow up, either in terms of the numbers of people in institutional care (Saudan 2002) or failing to return to the same residential status (Pajarinen 2005). The combined outcomes of nursing home or dead by one year, and failure to regain previous residential status, seriously ill or dead by four months also showed no significant differences between the two groups (*see* Analysis 4.9). Papasimos 2005 reported there was no difference between the two groups in return to pre-fracture level of independence or ambulation.

Pajarinen 2005 found that significantly fewer PFN group participants failed to recover their pre-fracture mobility (10/42 versus 19/41, RR 0.51, 95% CI 0.27 to 0.97); however, this result is not robust as shown by the combined outcome of failure to recover previous mobility or dead at four months (RR 0.67, 95% 0.38 to 1.17). For survivors available at one year in Saudan 2002, there were no statistically significant differences noted between groups for pain (mean scores: 1.36 versus 1.31), mobility (mean scores: 4.94 versus 5.07) or social function (mean scores: 2.88 versus 2.65). Papasimos 2005 reported the mean Salvati and Wilson scores (based on pain, walking, muscle power and motion, function; 0: worst to 40: best) at one year were comparable for the two groups (30 versus 27; P value not reported).

Targon PF nail versus the sliding hip screw (SHS)

One study (Giraud 2005) compared the Targon PF nail with the sliding hip screw in 60 people with intertrochanteric fractures.

Operative details

The mean length of surgery was 34 minutes for the nail versus 42 minutes for the SHS. The mean operative blood loss was 410 ml for the nail versus 325 ml for the SHS (reported P = 0.07; not significant).

Fracture fixation complications (*see* Analysis 5.1)

Giraud 2005 reported three cases of cut-out in the Targon PF group against two in the SHS group. All cases of cut-out were reoperated. No other fracture fixation complications were reported and there were no wound infections.

Anatomical restoration

This was not reported in Giraud 2005.

Post-operative complications (*see* Analysis 5.3).

There was one person with deep vein thrombosis and one with pneumonia (pulmonary congestion) in the Targon PF group. No medical complications were recorded in the SHS group. Mean hospital stay was 11 days for both groups.

Final outcome measures

Mortality at three months was similar for both groups in Giraud 2005 (*see* Analysis 5.4).

Giraud 2005 reported the mean time to walking was 20 days for the nail versus 25 days for the SHS (statistical significance not reported). The mean Harris hip scores (0: worst to 100: best function) were similar in the two groups (60 versus 59).

Mini-invasive intramedullary nail versus the sliding hip screw (SHS)

One study (Dujardin 2001) compared this experimental implant with the sliding hip screw in 60 people with intertrochanteric fractures.

Operative details (*see* Analysis 6.1)

The mean length of surgery, operative and total blood loss (including the blood loss into wound drains) were all significantly less in the nail group. No participants of the nail group required transfusion, whilst on average 1.5 units of blood per participant were transfused in the SHS group (reported P < 0.001). Radiographic screening time was equal in both groups.

Fracture fixation complications

Dujardin 2001 reported an absence of early post-operative complications but did not explicitly indicate if this included cut-out and other fracture fixation complications aside from further surgery. All fractures eventually united with no difference between the two implants in the time taken for fracture healing (*see* Analysis 6.2).

Post-operative complications

As stated above, Dujardin 2001 reported an absence, in the initial post-operative period, of early post-operative complications which included thromboembolism and sepsis. Hospital stay averaged 10 days in both groups but, when the length of stay in convalescence was included, participants of the nail group returned home earlier (46 versus 68 days; reported P < 0.05) than those in the SHS group. The numbers of participants in each group returning home were not given.

Anatomical restoration

Though some measures of anatomical restoration were presented, leg shortening results and full data for varus deformity were not provided by Dujardin 2001.

Final outcome measures

Mortality at one and six months was the same for both groups, being two and six participants of each group at the two time periods (*see* Analysis 6.3 for the six-months mortality data).

The intermediate functional outcomes of the time to painless mobilisation and the time to effective weight bearing (*see* Analysis 6.4) were both statistically significantly reduced for the nail group. Various aspects of hip function, including pain, power and mobility, were measured using the Salvati and Wilson score. The mean pain score was better for the nail group at six weeks (reported $P < 0.01$) but similar thereafter. No significant difference was noted for functional deficit at follow up. However, the hip power and motion score was reported to be significantly better in the nail group at six months (reported $P < 0.05$). Early knee mobility was more reduced in the nail group at six weeks (27 versus 10 degrees; reported $P < 0.05$), but at six months there was no residual deficit in either group.

Kuntscher-Y nail versus the sliding hip screw (SHS)

The only randomised trial identified (Davis 1988) compared the Kuntscher-Y nail with the sliding hip screw (SHS) in 230 people with intertrochanteric fractures.

Operative details

No data for these outcomes were reported.

Fracture fixation complications (*see* Analysis 7.1)

The most common complication reported was cut-out (12/116 versus 17/114; RR 0.69, 95% CI 0.35 to 1.39). In addition there was breakage or bending of the implant for two Kuntscher nails and one SHS, implant uncoupling for one Kuntscher nail, and "implant loosening" for one Kuntscher nail and four sliding hip screws. The overall fracture fixation complication rate was not statistically different between the two groups (16/116 versus 22/114; RR 0.71, 95% CI 0.40 to 1.29). Four participants of each group required a reoperation. There were no statistically significant differences between the two groups in superficial or deep wound infection (*see* Analysis 7.2).

Post-operative complications (*see* Analysis 7.3)

The complications reported in Davis 1988 were urinary infection, chest infections, thromboembolic complications and pressure sores. There was no significant difference in incidence of these complications between the two implants, although pressure sores tended to be more prevalent after the SHS.

Anatomical restoration (*see* Analysis 7.4)

There was a significant increase in the number of trial participants with more than 2.5 cm of shortening after Kuntscher nailing (17/48 versus 9/54; RR 2.13, 95% CI 1.05 to 4.31). There was no significant difference between the two groups in the incidence of varus angulation (defined as >15 degrees) or external rotation deformity (defined as >15 degrees).

Final outcome measures (*see* Analysis 7.5)

There was no statistically significant difference between the two groups in one year mortality (48/116 versus 41/114; RR 1.15, 95% CI 0.83 to 1.60) nor, for the survivors, in the numbers who failed to regain their pre-fracture level of mobility (40/68 versus 37/73; RR 1.16, 95% CI 0.86 to 1.57). The combined outcome (failure to regain mobility or death) again showed no significant difference between the two groups. However, for survivors with a good pre-fracture mobility, more people in the SHS group regained their mobility (loss in mobility: 20/32 versus 10/28; RR 1.75, 95% CI 0.99 to 3.08; subgroup analysis not shown). Davis 1988 reported without data that there were no differences between the groups in hip pain or loss of hip movement at one year.

Intramedullary nails (Gamma or PFN) versus the Medoff sliding plate

Miedel 2005 compared the Gamma nail with the Medoff sliding plate in 217 people and Ekstrom 2007 compared the proximal femoral nail (PFN) with the Medoff sliding plate in 203 people. Both studies included people with either an unstable trochanteric fracture or a subtrochanteric fracture.

Operative details

Neither trial found a statistically significant difference between the two groups in the mean length of surgery: Miedel 2005 reported 61 minutes for the Gamma nail versus 65 minutes for the Medoff plate; the data for Ekstrom 2007 are shown in Analysis 8.1. Both trials reported statistically significantly lower blood losses in the intramedullary nail groups: Miedel 2005 reported 276 ml for the Gamma nail versus 402 ml for the Medoff plate (reported $P < 0.01$); the data for Ekstrom 2007 are shown in Analysis 8.2 (mean difference -297.00 ml, 95% CI -414.33 to -179.67 ml). Miedel 2005 reported no statistically significant difference in the mean volume of blood transfused (864 ml versus 800 ml), and Ekstrom 2007 reported, without confirmatory data, no difference between the two groups in the numbers of blood transfusions. The mean radiographic screening time was two minutes greater in the PFN group of Ekstrom 2007 (*see* Analysis 8.3).

Fracture fixation complications

All four cases of operative fracture of the femur occurred in the nail groups of the two trials (*see* Analysis 8.4). There were no later fractures of the femur in either study. There were no statistical significant difference between groups for cut-out (*see* Analysis 8.6: 9/214 versus 6/206; RR 1.44, 95% CI 0.52 to 4.01), non-union (*see* Analysis 8.7) or technical complications of fixation (see Analysis 8.8: 14/214 versus 11/206; RR 1.23, 95% CI 0.57 to 2.65). Not included in Analysis 8.8 was the late diagnosis of a stress fracture in the femoral neck resulting in revision to a total hip replacement for one person in the Medoff plate group of Miedel 2005. Miedel 2005 also reported three cases of excessive medial displacement of the femur requiring revision surgery in the Medoff group. These cases contributed to the greater, but not statistically significantly greater, number of reoperations in the Medoff group in Miedel 2005 (*see* Analysis 8.9: 3/109 versus 9/108; RR 0.33, 95% CI 0.09 to 1.19). Conversely, Ekstrom 2007 reported a significantly higher reoperation rate in the PFN group (*see* Analysis 8.9: 9/105 versus 1/98; RR 8.40, 95% CI 1.08 to 65.09).

Data for any type of wound infection from the two trials were not pooled due to significant heterogeneity (I^2 = 83.9%); there was a trend to less infection in the Gamma nail group of Miedel 2005, and conversely a trend to greater infection in the PFN group of Ekstrom 2007 (*see* Analysis 8.10). There was no statistically significant differences between the two groups in deep wound infection (data from Miedel 2005; *see* Analysis 8.11) or wound haematoma (data from Ekstrom 2007; *see* Analysis 8.12).

Post-operative complications

Miedel 2005 reported similar numbers of survivors in the two groups with severe general complications (cardiac, pulmonary, thromboembolic or cerebrovascular) at four months (*see* Analysis 8.13). There was no mention of medical complications in Ekstrom 2007. Miedel 2005 reported mean length of stay in the orthopaedic ward was six days for both groups. Ekstrom 2007 reported the mean length of hospital stay was 12 days with no difference between the two groups.

Anatomical restoration

This was not reported in either Miedel 2005 or Ekstrom 2007.

Final outcome measures

Both studies found no statistical difference between groups in mortality at one year (*see* Analysis 8.14: 39/214 versus 49/206; RR 0.77, 95% CI 0.53 to 1.12).

Miedel 2005 reported there were no significant differences between the two groups in pain, hip movement or walking ability scores assessed in the Charnley score for hip function, nor in activities in daily living (Katz) or health related quality of life scores (EuroQol) in those participants without severe cognitive dysfunction. Ekstrom 2007 reported, without supporting data, there was no statistically significant difference between the two groups in pain or return home at one year from injury. Similarly, there were no statistically significant differences between the two groups of Ekstrom 2007 for four measures of mobility at one year: inability to walk 15 metres, inability to rise unassisted from a chair, inability to climb a curb, and need for walking aids other than one crutch (*see* Analyses 8.15 to 8.19).

Femoral nails versus condylar screw or blade plates

Two trials compared a femoral nail with either a dynamic condylar screw (DSC) plate (Sadowski 2002) or a 90-degree blade plate (Pelet 2001) for specific types of lower trochanteric fracture, including reversed fracture lines and transverse fractures at the level of the lesser trochanter. Since the fracture types, as well as the implants being compared, are similar these two trials are considered together, though presented as separate subcategories in the analyses. These fractures are uncommon and the trial populations in the two trials were small with 39 participants in Sadowski 2002 and 26 participants in Pelet 2001.

Operative details

In Sadowski 2002, the mean length of surgery for the proximal femoral nail (PFN) group was under half that of the DSC group (*see* Analysis 9.1: 82 versus 166 minutes; mean difference -84.00 minutes, 95% CI -115.71 to -52.29 minutes). A similar difference in mean operation times between the Gamma nail and blade plate groups was found in Pelet 2001 (86 versus 169 minutes, reported $P < 0.05$).

Significantly fewer participants of the PFN group of Sadowski 2002 received blood transfusion (*see* Analysis 9.2: 11/20 versus 18/19; RR 0.58, 95% CI 0.39 to 0.88). The mean number of units of blood transfused was also less in the PFN group (1.5 versus 3.0 units). Pelet 2001 reported the mean operative blood loss was lower in the Gamma nail (550 ml versus 1150 ml, reported $P < 0.05$).

The mean radiographic screening time was around four minutes for both implants of Sadowski 2002 (*see* Analysis 8.3).

Fracture fixation complications

In Sadowski 2002, no cases of implant failure were reported in the PFN group, whereas five cases of cut-out of the implant from the femoral head and one breakage of the implant occurred in the DSC group. There was one case of non-union in each group. Six reoperations were undertaken in the DSC group; these involved implant removal and debridement in five cases and a hip prosthesis in one case. The two “minor” reoperations undertaken to remove the distal locking screw in order to change the PFN to a dynamic construct are not counted in the analysis. This is because of the minimal nature of these operations, which are often undertaken under local anaesthesia as a day case.

One cut-out and one operative fracture of the femur occurred in the Gamma nail group of Pelet 2001. In the blade plate group, there was one operative fracture of the femoral neck, two non-unions, three cases of avascular necrosis and one plate breakage. No one in either group had a reoperation because of “low functional demand”.

Overall, there were significantly fewer fracture healing complications in the nail group (*see* Analysis 9.7: 3/31 versus 13/30; RR 0.23, 95% CI 0.07 to 0.71). The pooled results for reoperations were not statistically significant (*see* Analysis 9.8: 0/33 versus 6/32; RR 0.07, 95% CI 0.00 to 1.22).

Deep wound infection was reported in one case in the DSC group of Sadowski 2002. Wound healing complications occurred in similar numbers in the two groups (3 versus 2) for this trial. Pelet 2001 did not report this outcome.

The mean time to fracture “consolidation” was longer in the PFN group of Sadowski 2002 (6.5 versus 5.0 months); this difference was reported as not statistically significant. Conversely, Pelet 2001 reported that the mean time to fracture consolidation was 4.2 months in the Gamma nail group versus 6.3 months in the plate group (reported $P < 0.05$).

Post-operative complications

For both studies, there were no significant differences between the two groups in the numbers of participants with medical complications, either overall (*see* Analysis 9.14: 16/33 versus 13/32; RR 1.20, 95% CI 0.69 to 2.06) or, where these occurred, for specific complications (*see* Analyses 9.10 to 9.13).

In Sadowski 2002, PFN group participants stayed on average five fewer days in hospital (*see* Analysis 9.15: 13 versus 18 days; mean difference -5.00 days, 95% CI -8.60 to -1.40). The average stay in acute hospital was also reported as less for the nail group of Pelet 2001: 33 versus 44 days.

Anatomical restoration

This outcome was not reported in Sadowski 2002. Pelet 2001 reported that the mean external rotation deformity was the same in both groups. Flexion was 112 degrees in the nail group compared with 96 degrees in the blade plate group (reported P = 0.05).

Final outcome measures

Both trials found no difference between the two groups in mortality at one year (*see* Analysis 9.16). Sadowski 2002 also found no difference in nursing home residence.

Functional scores (for pain, mobility and social function) at one year were only provided for survivors without fracture healing complications in Sadowski 2002; no statistically significant differences between the two groups were reported for these outcomes. There were no statistically significant differences between the two groups of Pelet 2001 in the numbers of people with residual pain (3/13 versus 5/13) or requiring walking aids (6/13 versus 10/13) at one year (*see* Analyses 9.17 and 9.20 respectively).

DISCUSSION

Four types of femoral nails (Gamma, IMHS, PFN and Targon PF) versus the sliding hip screw (SHS)

Pooling of the results of the comparisons of four nails (Gamma, IMHS, PFN and Targon PF) versus the SHS showed a consistent picture of higher rates of operative and later fracture of the femur, and technical complications of fixation for femoral nails. In the absence of evidence showing a superiority in functional and longer term outcomes (follow up was generally 12 months or less) for these nails, the increased risk of later femur fracture and reoperation are key findings. Pooled results show that using these nails results in one extra later femur fracture in every 50 trial participants (95% CI 1 in 33 to 1 in 100) and one extra reoperation in every 50 trial participants (95% CI 1 in 25 to 1 in 100). These results are dominated by the weight of evidence available for the Gamma nail.

Gamma nail versus the sliding hip screw

The initial reports of the use of the Gamma nail were simple reviews of the implant that suggested its potential value. However, these studies observed that femoral fracture was the main complication and this has been confirmed by results from randomised trials in both the original version of this review and subsequent updates. This complication is the main difference between the two implants. Inadequate reaming and the use of excessive force on nail insertion have been implicated as the cause of femoral fracture. More recent reports of the Gamma nail have emphasised the need to over-ream the femur by 2 mm, ream the greater trochanter to 17 mm and never to hammer the nail into place. In addition, several modifications to the design of the Gamma nail and its instrumentation have occurred since its introduction. The most recent version of the nail is the Trochanteric Gamma nail (Gamma III). However, it remains uncertain whether such attention to operative technique or changes to the design of the implant will reduce the risk of later fracture of the femur. The most recent study (Ovesen 2006) still reported an increased incidence of fracture healing complications and re-operations with the nail. These technical issues and the use of a modified nail require further investigation.

The problem of a learning curve for a new implant may jeopardise effective assessment within randomised trials. Thus it may be that some of the complications experienced with the Gamma nail would not have occurred had the surgeons been as familiar with the operative technique as they were with the SHS, the more established implant. Four trials (Benum 1994; Goldhagen 1994; Guyer 1991; Hoffman 1996) specifically referred to a learning curve for Gamma nail insertion, and a further trial (O'Brien 1995) mentioned a performance bias with regards to surgery. Many trials, however, tried to overcome this by restricting the number of surgeons, or using only those experienced in intramedullary fixation. Analysis of those trials which stated that operations were only performed by surgeons experienced with the two devices, in comparison with the other trials, failed to show any statistically significant difference in outcome measures (specifically cut-out and operative fracture) between these two groups.

Later fracture below the nail is probably the most significant difference between these two implants. This complication, although rare is devastating for the patient requiring either major revision surgery or a prolonged period of traction and bed rest. Whilst operative fracture of the femur is more common with the Gamma nail, this complication may not require any specific treatment and was generally treated by ensuring the Gamma nail was locked distally at surgery or using a longer Gamma nail. The other technical complication of cut-out of the lag screw from the femoral head showed no significant difference between the two implants. Neither was there any difference in wound infection or haematoma with the Gamma nail.

There is no substantial difference in mortality between the two implants. Although incomplete outcome data for functional outcomes remains a problem for the evaluation of the Gamma nail, the limited data available for morbidity, as assessed by residual pain and change in function, suggest there is no important difference.

No definite conclusions of effect can be drawn from the limited and heterogeneous data available for the operative details of length of surgery, operative blood loss and length of radiographic screening time. The inconsistency between studies for the last two outcomes may in part reflect the known disparity in the experience of the surgeons performing the two operations in Leung 1992. Irrespective of this, the main differences between the implants continue to be related to operative and later femur fractures.

We were unable to obtain adequate information from the included studies to make any distinction in outcome for unstable versus stable trochanteric fractures. The Gamma nail may have advantages for selected fracture types such as subtrochanteric fractures and trochanteric fractures with a reversed obliquity fracture line. These fractures have a high incidence of fixation failure when treated with an extramedullary fixation implant such as the SHS (Haidukewych 2001), and intramedullary fixation for such fractures is often recommended. Further studies are required to clarify if the Gamma nail or another intramedullary nail is superior for these fractures. We have been unable to obtain additional data from those studies which included subtrochanteric fractures about the outcomes for these patients. The more recent introduction of the long Gamma nail for subtrochanteric fractures again requires further evaluation.

Intramedullary hip screw (IMHS) versus the sliding hip screw

Only limited conclusions can be drawn given the smaller number of patients studied in the five included studies. Nonetheless the eight cases of operative fracture of the femur and the four cases of later fractures below the implant all occurred in the IMHS group. This suggests that this implant has similar characteristics to those of the Gamma nail. These complications, particularly that of later fracture below the implant, may be technically demanding to treat and will outweigh the potential benefits claimed for the IMHS of a reduced operative time and operative blood loss. Neither of these claims have been demonstrated within the included studies. Post-operative complications, mortality and functional outcomes were similar in both groups. There was some indication of enhanced early regain of mobility in the IMHS group in Hardy 1998 and earlier weight-bearing for this group in Hoffmann 1999, but there was little indication of a sustained functional effect and the slight tendency to more long term pain in the IMHS group in Baumgaertner 1998 and Hardy 1998 is of concern.

Proximal femoral nail (PFN) versus the sliding hip screw

Pooled results of the three trials for this comparison showed no statistically significant differences between the two implants in fracture fixation complications, reoperation, wound infection and length of stay. The statistically significant findings of individual trials, namely the increased radiographic screening time and urinary tract infection for the PFN (Saudan 2002), and the better mobility of survivors of the PFN group (Pajarinen 2005) need to be seen as being results from one trial only and in context of the other outcomes (for instance, there was no significant difference in overall medical complications in Saudan 2002). Overall, there is insufficient evidence for this comparison. Four of the five reoperations in the PFN group of Papasimos 2005 resulted from the 'Z effect', which describes the cutting out of one of the PFN proximal pins with backing out of the other pin. Other instances of this have been reported in case series and it was these difficulties for the PFN that led to the suspension of Moran 2000 (*see* 'Characteristics of excluded studies' table).

Targon PF nail versus the sliding hip screw

The single and small trial making this comparison (Giraud 2005) provided insufficient evidence to conclude on the relative effectiveness of the two implants.

Mini-invasive intramedullary nail versus the sliding hip screw

As acknowledged by Dujardin 2001, no definite conclusions should be made regarding the use of this presently experimental implant from this small trial. Whilst the use of one surgeon to undertake each type of operation may reduce problems with operator inexperience, it is possible that differences, especially in operative times and blood loss, may be related to differences in the techniques of the individual surgeons involved as well as due to other confounding factors. Dujardin 2001 state that a multicentre study, justified by the preliminary results of their study, is now underway.

Kuntscher-Y nail versus the sliding hip screw (SHS)

Results from the only trial identified (Davis 1988) indicate comparable results between the Kuntscher nail and the SHS. The overall incidence of fixation failure was high in both groups, with a cut-out rate of 14.9% for the SHS group. In contrast, this review has identified a cut-out rate of 2.9% for the SHS when compared with the Gamma nail. The only outcome measures that were significantly different between implants were those of limb shortening and recovery of mobility for those with good pre-fracture mobility. Both were superior for the SHS. Future use and further trials using the Kuntscher-Y nail seem inappropriate given that the outdated implant is now superseded by newer intramedullary nails that have improved instrumentation and the capacity for distal locking to reduce the risk of limb shortening.

Femoral nails versus the Medoff sliding plate

Two trials (Ekstrom 2007; Miedel 2005) addressing this comparison showed no notable differences between the two implants in final outcomes. Pooling of the results for the outcomes of reoperation and wound infection was not done due to significant heterogeneity in the findings of the two trials. Results for both these outcomes favoured the Gamma nail in Miedel 2005, and the Medoff plate in Ekstrom 2007. It is not possible, given the limited evidence available for this comparison, to make any clear recommendation on the relative effectiveness of the nails versus the Medoff plate.

Femoral nails versus condylar screw or blade plates

Both studies for this comparison (Sadowski 2002; Pelet 2001) included fractures occurring at the level of the lesser trochanter; this includes transverse and reverse obliquity fracture types. Such fractures are known to have a markedly increased risk of fixation failure in comparison to trochanteric fractures (Haidukewych 2001). Only 65 cases were included overall, reflecting the relatively rare occurrence of these types of fracture. The comparison implants (Gamma nail and PFN; dynamic condylar screw (DSC) plate and the 90 degree blade plate) for these studies are sufficiently similar to warrant the studies being considered in one category. For these fractures, both the DSC and blade plates act as a rigid and static fixation plate.

The intramedullary nails were associated with better results for length of surgery, transfusion requirements, fixation failure rate, reoperation rate and hospital stay in comparison with the plates. Final outcome measures appeared to be similar between the two groups. Thus for these fractures, an intramedullary nail appears to give superior results to those of static plate fixation.

AUTHORS' CONCLUSIONS

Implications for practice

Accumulated data from randomised controlled trials show no evidence of clinical advantage for the Gamma nail when compared with the sliding hip screw (SHS). The Gamma nail incurs complications of intra-operative and later fracture around the implant. Therefore, for trochanteric fractures, the SHS appears to be the better device.

Results from randomised trials comparing the Intramedullary Hip Screw (IMHS) with the SHS suggest that this implant suffers from similar complications to that of the Gamma nail. Additional studies are required to confirm this and to provide data to support any claims of longer term functional advantage.

Pooled results of two trials evaluating the proximal femoral nail (PFN) against the SHS showed no advantages for the PFN for trochanteric fractures. Further evidence would be required to justify the use of the PFN for these fractures.

The two small studies comparing an intramedullary nail with static plate fixation for treating more distal and uncommon trochanteric fractures suggested that intramedullary nailing gave better intra-operative and fracture fixation results. However this needs to be viewed with caution given the limited number of participants.

Implications for research

Future research on contemporary implants should be planned with close attention to improving the quality of trial design and reporting (*see* CONSORT statement: Moher 2001). Particular deficiencies in the published literature are poor concealment of allocation, failure to report outcomes related to fracture type and limited information on participants who withdrew or for whom follow up was incomplete, limited reporting of functional outcomes and patient-derived quality of life measures, and insufficiently long follow up.

Appropriate directions for future research include the place of intramedullary nails in subtrochanteric and reversed-obliquity trochanteric fractures. Design changes to different types of intramedullary nails, claimed to reduce the risk of post-operative fracture, should be tested versus the SHS in adequately powered randomised trials.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Adams 2001

Methods	Randomised by sequentially numbered closed opaque sealed envelopes Surgical experience (see Footnotes): Yes (Claimed experience in both implants)
Participants	Orthopaedic hospital, UK. 400 participants Trochanteric proximal femoral fractures. Age: mean 81 years % male: 22% Number lost to follow up: 0.3%
Interventions	Gamma intramedullary nail versus Richards Compression hip screw
Outcomes	Length of follow up: 12 months Length of surgery Operative blood loss Fall in haemoglobin Number of patients transfused Operative fracture of the femur Later fracture of the femur Cut-out of implant Detachment of the plate from the femur Reoperation Deep wound infection Superficial wound infection Deep vein thrombosis Mortality Use of walking aids Place of residence at follow up Harris hip score
Notes	Information of study supplied by trialists prior to publication

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Ahrengart 1994

Methods	Randomised by consecutively opened sealed envelopes Surgical experience: Yes (Gamma nail: learning period before trial; SHS: routine)
Participants	Five orthopaedic hospitals, Sweden and Finland 548 participants Trochanteric and subtrochanteric fractures. But the 2002 report only included 492 trochanteric proximal femoral fractures. The baseline data and early results for 66 patients lost to follow-up were not reported. Age: median 80 years (range 32-99 years) % male: 29% Number lost to follow up: 13%
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Transfusion Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (pseudarthrosis) Delayed healing Reoperation Wound infection Deep wound infection Superficial wound infection Thromboembolic complication (deep vein thrombosis, pulmonary embolism) Clinical complications (pneumonia) Length of hospital stay Shortening of leg Varus displacement Mortality at 6 months Pain at follow up Return to pre-fracture residential status Failure to regain mobility Use of walking aids Length of skin incision
Notes	A report (2002) of the results for patients with trochanteric fractures from all five centres of this study is now available. It is however less comprehensive than the report, used in previous versions of this review, by Fornander et al 1994 which gave the results for two centres and 209 patients, including 19 with subtrochanteric fractures. Fornander also provided a pre-publication report and additional information for these two centres. Clarification on results and methods from Leif Ahrengart is pending (September 2003). Given the absence of information on 66 patients lost to follow up in the five centre report and some lack of clarity or potential inconsistencies with the two centre study regarding surgical experience, trial inclusion criteria, outcome definitions and some results (i.e. there was one deep wound infection in the SHS group in the Fornander report but none in the five-centre report), we have kept the data from the two centre report.

Ahrengart 1994 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Baumgaertner 1998

Methods	Randomised by sealed opaque envelopes opened sequentially Surgical experience: No (Gamma nail: familiar with IM nailing but not the Gamma nail; SHS routine; surgery by residents under supervision, 30 participating surgeons)
Participants	Two orthopaedic hospitals, USA 131 participants 135 trochanteric femoral fractures (4 of these were fractures which occurred several months later in the same patients) Excluded: pathological fractures. Age: mean 79 years (range 40-99 years) % male: 34% Number lost to follow up: none
Interventions	Intramedullary hip screw versus Sliding hip screw
Outcomes	Length of follow up: mean 28 months (range 4-54 months) Length of surgery Operative blood loss Transfusion Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Wound haematoma Major medical complication Length of hospital stay Mortality Hip pain at follow up Return to pre-fracture residence Patient mobility
Notes	Slight confusion with use of patient or fracture numbers in the trial report. Trialist explained that 4 patients had 2 fractures which were operated on several months apart (they were not bilateral fractures). These were considered separate operations and different cases for pre-op and operative data. Two of the 4 patients received both IMHS and SHS, and were excluded from longer term follow-up data but not mortality. Curtin's abstract reporting early results for 70 patients shows the dangers of interim trial reports.

Baumgaertner 1998 (*Continued)*

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Benum 1994

Methods	Randomised by envelopes Surgical experience: No (Unknown for all centres but for sub-group from one centre, Aune et al 1993: Gamma nail: residents with varying experience of IM nailing (refers to learning curve); SHS: routine)
Participants	Orthopaedic hospitals, Norway 912 participants (interim results for 460) Trochanteric and subtrochanteric proximal femoral fractures. Age: not stated % male: not stated Number lost to follow up: 21%
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant (fracture dislocation) Non-union (fracture healing) Reoperation Wound infection Deep vein thrombosis Pulmonary embolism Length of hospital stay Mortality Institutional stay Walking function
Notes	Data used in analyses tables are based on interim data for 460 patients published in 1992 in an abstract. Details for the completed trial of 912 patients were given in an another abstract published in 1994. The references Aune et al 1993 and Ekeland et al 1993 (x2) report the results of 378 patients recruited by one of the centres of the multicentre trial reported by Benum. Madsen et al 1996 refers to a subgroup from this centre. The follow up for these patients was 10 to 27 months. A later trial report by Madsen et al 1998 also includes a subgroup from this trial. A slightly modified Gamma nail was used (6 degree valgus angle). Not included in the analyses for reoperation are the final data for Benum 1994 (29/429 versus 7/467), which are consistent with the general result.

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Bridle 1991

Methods	"Randomised": method not specified Surgical experience: Yes (All 4 surgeons familiar with closed nailing techniques)
Participants	Orthopaedic hospital, UK 100 participants Trochanteric proximal femoral fractures. Age: mean 82 years (all over 60 years) % male: 16% Number lost to follow up: 6%
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation (incomplete data) Wound infection Wound haematoma Pneumonia Pressure sore Pulmonary embolism Any medical complication Length of hospital stay Shortening of femur (leg) (no information) Mortality Pain (no information) Eventual discharge residence Patient mobility
Notes	Some discrepancies between tables and text in report.

Risk of bias		
Item	**Authors' judgement**	**Description**

Allocation concealment?	Unclear	B - Unclear

Butt 1995

Methods	Quasi-randomised by even or odd numbered weeks Surgical experience: No (Unknown; same surgeons did both operations)
Participants	Orthopaedic hospital, UK 95 participants Trochanteric and subtrochanteric proximal femoral fractures. Age: mean 78.5 years (range 47-101 years) % male: 31% Number lost to follow up: none
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: 'to fracture union' (generally < 6 months) Length of surgery Blood loss Later fracture of the femur Cut-out of implant (incomplete data?) Non-union (time to union) Reoperation (total inferred) Wound infection Pneumonia Pressure sore Deep vein thrombosis Any medical complication Length of hospital stay Mortality
Notes	Gamma nail technique modified without apparent advantage after 37 gamma nail patients.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Davis 1988

Methods	Randomised using numbered sealed opaque envelopes opened after patient assigned a trial numbers (via random numbers table) Surgical experience: No (Unknown; operations performed by consultants or trainees)

Davis 1988 (*Continued*)

Participants	Two orthopaedic hospitals, UK 230 participants Intertrochanteric proximal femoral fractures. Excluded: patients aged <50, pathological and Pagets fractures. Age: mean 81 years % male: 17% Number lost to follow up: none
Interventions	Kuntscher-Y nail versus Sliding hip screw
Outcomes	Length of follow up: 12 months Length of surgery Blood loss Mean units blood transfused Radiographic screening time Length of hospital stay Length of hospital stay and convalescence Mortality (1 month and 6 months) Radiographic healing time Time to weight bearing Salvati and Wilson score Functional deficit Power and motion at hip Knee mobility Time till painless mobilisation
Notes	Hip nail used was described as an experimental device which is not available commercially

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Dujardin 2001

Methods	Randomised: method not stated Surgical experience: Yes (All operations were undertaken by two surgeons with experience of the surgical technique; one surgeon did all the SHS operations and the other did all the nail operations)
Participants	Orthopaedic hospital, Rouen, France 60 participants Intertrochanteric proximal femoral fracture (stable and unstable fractures). Excluded: patients aged <60, pathological, lower limb arteriopathy, fractures extending to the diaphysis, previous lesions of the hip, surgery after 2 days from fracture, cutaneous lesions, abnormal calcium or phosphorus metabolism and no consent. Age: mean 83.5 years

Dujardin 2001 (*Continued)*

	% male: 20% Number lost to follow up: not stated
Interventions	A mini-invasive static intramedullary nail versus Sliding hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Mean units blood transfused Radiographic screening time Non-union; time to union Early post-op complications (infection, thromboembolism, further operation) Pneumonia Pressure sores All medical complications Length of hospital stay Varus deformity (reported for the nail group) Angular restoration Mortality Pain Failure to regain mobility Hip function Knee mobility
Notes	This experimental nail is not available commercially. The paper reported on radiographic measurements of anatomical restoration (cervicotrochanteric shortening and cervico-diaphyseal angle). However clinical outcomes such as leg shortening were not reported.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Ekstrom 2007

Methods	Randomised using numbered sealed opaque envelopes Surgical experience: No (Operations performed by 43 different surgeons, consultants or trainees)
Participants	Two orthopaedic hospitals, Sweden 210 participants (see Notes) Unstable intertrochanteric proximal femoral fractures (172) and subtrochanteric fractures (31). Excluded: people with stable trochanteric fractures, high energy trauma, pathological fractures, previous surgery to the proximal femur, daily steroids of more than 10 mg of prednisolone, ongoing chemotherapy, irradiation treatment, presence of degenerative osteoarthrosis of the injured hip. Age: mean 82 years (range 48 -97 years) % male: 24% Number lost to follow up: 25% (50 surviving patients were unable to attend the follow-up clinic at one

Ekstrom 2007 (*Continued)*

	year from injury)
Interventions	Proximal femoral nail versus the Medoff sliding plate (4 or 6 hole plate used in biaxial mode for trochanteric fractures and uni-axial mode for the subtrochanteric fractures)
Outcomes	Length of follow up: 12 months Length of surgery Blood loss Radiographic screening time Cut-out of implant Non-union Operative fracture of the femur Later fracture of the femur Other fracture healing complications Reoperation Wound infection Wound haematoma Length of hospital stay Mortality Failure to return to pre-fracture residential status Pain Inability to walk 15 metres Inability to rise from the chair Inability to climb a curb Need to use walking aids Abductor strength
Notes	Of 210 randomised patients, 7 were excluded: 5 wrong fracture and 2 wrong treatment

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Giraud 2005

Methods	Randomised using random numbers table Surgical experience: No (Unknown)
Participants	Orthopaedic hospital, Reims, France 60 participants Intertrochanteric proximal femoral fracture (stable and unstable fractures: AO 31-A1,A2 and A3). Age: mean 81/82 years % male: 23% Number lost to follow up: none
Interventions	Targon PF (proximal femoral) nail versus Dynamic hip screw

Giraud 2005 *(Continued)*

Outcomes	Length of follow up: 3 months Length of surgery Blood loss Cut-out of implant Later fracture of the femur Reoperation Wound infection (none) Pneumonia (pulmonary congestion: "Pulmonaire") Deep vein thrombosis Length of hospital stay Mortality Time to walking Harris hip score
Notes	Extra information supplied by trialists.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Goldhagen 1994

Methods	Quasi-randomised according to patient's medical record number Surgical experience: No (Gamma nail: refers to significant learning curve. A "multiplicity of operating surgeons")
Participants	Orthopaedic hospital, USA 75 participants Trochanteric and subtrochanteric proximal femoral fractures. Age: median 76 years (range 28-91 years) % male: 30% Number lost to follow up: none
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow up: 6-9 months Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Length of hospital stay

Goldhagen 1994 *(Continued)*

	Mortality Pain at follow up Non return to previous residence Impaired walking
Notes	Slight discrepancies in numbers Tables 1 and 2.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Guyer 1991

Methods	Quasi-randomised by alternating patients Surgical experience: No (Gamma nail: refers to inexperience of surgeons with implant)
Participants	Orthopaedic hospital, Switzerland 100 participants Trochanteric and subtrochanteric proximal femoral fractures. Age: mean 80 years % male: 15% Number lost to follow up: 24%
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: 12 weeks Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Deep wound infection Wound haematoma Length of hospital stay Shortening of leg (>1 cm) Mortality Pain at follow up Non-return to previous residence Impaired walking
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Hardy 1998

Methods	Quasi-randomised by even or odd medical record numbers Surgical experience: No (IMHS: refers to prolonged learning curve required for insertion; SHS routine; 2 senior operating surgeons, 3 junior attending surgeons)
Participants	University hospital, Belgium 100 participants (see Notes) Trochanteric proximal femoral fractures. Excluded: Patients aged <60, pathological fractures, incorrect anatomy, history of fracture or operation involving same limb. Age: mean 81 years % male: 23% Number lost to follow up: none
Interventions	Intramedullary hip screw versus Sliding hip screw
Outcomes	Length of follow up: 1 year (see Notes) Length of surgery Operative blood loss Transfusion Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Wound infection Wound haematoma Pneumonia Thromboembolic complications (deep vein thrombosis, pulmonary embolism) Urinary tract infection Leg shortening Mortality Mid-thigh pain Hip pain at follow up Eventual discharge residence Patient mobility Social function
Notes	Since a full report of the trial was published in 1998, a conference abstract presenting the results of 160 patients at 18 months follow up has become available (Hardy 1999). The limited results presented within Hardy 1999 require clarification and thus have not yet been included in this review.

Hardy 1998 (*Continued)*

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	No	C - Inadequate

Harrington 2002

Methods	Randomised by opening sealed envelope on the admission ward Surgical experience: No (Reference made to some surgeons who had only used the IMHS on bone model sessions)
Participants	Orthopaedic hospital, UK 102 participants Unstable trochanteric proximal femoral fractures. Excluded: Patients aged <65 years, pathological fractures, previous fracture, other fracture. Age: mean 83 years % male: 21% Number lost to follow up: not stated
Interventions	Intramedullary hip screw versus Sliding hip screw
Outcomes	Length of follow up: 12 months Length of surgery Radiographic screening time Transfusion requirements Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union of fracture Other fracture healing complications Length of hospital stay Mortality Patient mobility Regain of pre-fracture living status
Notes	Additional information provided by authors

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Haynes 1996

Methods	Randomisation by cards, but trial entry optional Surgical experience: No (Not clear. Gamma nail: prior experience with five insertions but speaks of unfamiliarity of the surgeons (various) with the treatment as a reason for exclusion (see Notes); SHS: routine)
Participants	Orthopaedic hospital, UK 50 participants Trochanteric or 'high' subtrochanteric proximal femoral fractures. Excluded: Previous non-consolidated femur fracture. Age: mean 80 years. % male: 28% Number lost to follow up: none
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Operative fracture of femur* Cut-out Non-union* Reoperation Wound infection* Pneumonia* Pressure sore* Wound haematoma* Deep vein thrombosis* Pulmonary embolism* Length of hospital stay Shortening of leg* Mortality Pain at follow up* Non return to previous residence Impaired walking * outcomes listed on data extraction form but not reported
Notes	Trial report was part of PhD research. Trial sponsored and part administered by Howmedica. Imbalance in numbers explained by unfamiliarity of surgeons with Gamma nail treatment. "This resulted in a temptation to omit the patient from the trial if a Gamma nail was drawn as treatment, from the randomisation cards". This was despite the efforts made to familiarise the surgeons to the Gamma nail: "a minimum of 5 Gamma Nails were then inserted by each surgeon before any cases were included in the trial"

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Hoffman 1996

Methods	Randomised by sealed opaque envelopes (a stiff card was used to prevent disclosure of allocation) Surgical experience: No (Gamma nail: refers to a longer learning curve than with SHS; 4 orthopaedic trainees, normal supervision)
Participants	Orthopaedic hospital, New Zealand 69 participants Trochanteric proximal femoral fractures. Patients aged over 50 years. Pathological fractures were excluded. Age: mean 81 years % male: 23% Number lost to follow up: none
Interventions	Gamma intramedullary nail versus Ambi hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (time to union) Reoperation Wound infection Pneumonia Pressure sores Deep vein thrombosis Any medical complication Length of hospital stay Shortening of leg Mortality Pain at follow up Non return to previous residence Patient mobility
Notes	Additional data received. There were 69 patients randomised but 2 died before surgery and were therefore not included. Updated recommendations on locking for Gamma nail insertion from manufacturers were implemented after patient 50.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Hoffmann 1999

Methods	Randomised by sealed envelopes; blinding indicated Surgical experience: No (Operations by junior and senior staff)
Participants	Orthopaedic hospital, Germany 110 participants Trochanteric proximal femoral fractures. Excluded: pathological fractures. Age: mean 82 years % male: 20% Number lost to follow up: 3.6%
Interventions	Intramedullary hip screw versus Sliding hip screw
Outcomes	Length of follow up: mean 3.7 months Length of anaesthesia Length of surgery Operative blood loss Difference in haemoglobin Radiographic screening time Operative fracture of the femur Later fracture of the femur Loss of fracture reduction requiring reoperation Reoperation Wound infection Deep wound infection Wound haematoma Superficial wound infection Thromboembolic complication Clinical complications Length of acute hospital stay Shortening of leg (> 1 cm) Rotational deformity ('relevant') Mortality Pain at follow up Return to pre-fracture residential status Impaired walking Merle d'Aubigne hip score
Notes	Article in German - limited translation only obtained.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Kukla 1997

Methods	Randomised using sealed envelopes Surgical experience: Yes (Senior surgeons experienced in both operations)
Participants	Orthopaedic hospital, Austria 120 participants Trochanteric proximal femoral fractures. Excluded: Patients aged <60 years, pathological fractures, multiple injury patients. Age: mean 83 years (range 60-99 years) % male: 15% Number lost to follow up: 3 (3%)
Interventions	Gamma intramedullary nail versus Sliding hip screw
Outcomes	Length of follow up: 6 months Length of surgery Blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Wound infection Deep wound infection Wound haematoma Pneumonia Deep vein thrombosis Pulmonary embolism Any medical complication Length of hospital stay Shortening of leg (>2 cm) Mortality Non-return to previous residence Impaired walking
Notes	Additional information received from authors included draft report prior to publication.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Kuwabara 1998

Methods	Randomised trial: method not stated Surgical experience: No (Unknown)

Kuwabara 1998 (*Continued*)

Participants	Orthopaedic hospital, Japan 43 participants Trochanteric proximal femoral fractures. Excluded: patients <65 years. Age: mean 81 years % male: 28% Number lost to follow up: not known
Interventions	Gamma intramedullary nail versus Compression hip screw
Outcomes	Length of follow up: mean 6 months (5.7 and 6.5 months respectively for the two groups) Length of surgery Operative blood loss Operative fracture of the femur Later fracture of the femur Cut-out of implant Wound infection Inversion deformity Eversion deformity Loss in mobility and use of walking aids
Notes	Trial published in Japanese. Only a limited translation obtained.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Leung 1992

Methods	Quasi-randomised by alternating patients Surgical experience: No (Imbalance in experience (see Notes): Gamma nail: mostly by one experienced surgeon; SHS: by less experienced surgeons)
Participants	Orthopaedic hospitals, Hong Kong 225 participants 226 trochanteric proximal femoral fractures. Excluded: Patients aged <65 years. Age: mean 80 years % male: 30% (excluding deaths) Number lost to follow up: none
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: mean 7 months Length of surgery

Leung 1992 (*Continued)*

	Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (fracture healing) Reoperation Deep wound infection Pneumonia Any medical complication (incomplete) Length of hospital stay (mixed location) External rotational deformity Shortening of leg (>2 cm) Varus displacement (>10 degrees) Mortality Pain at follow up Impaired walking
Notes	The 40 patients who died within 6 months of surgery were not included in the full assessment of results. Further information obtained from author. Most of the Gamma nail operations were performed by one senior surgeon with a special interest in intramedullary nailing, whilst the sliding hip screw operations were performed by a number of less experienced surgeons.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Marques Lopez 2002

Methods	Quasi-randomised according to medical record number Surgical experience: No (Variable)
Participants	Orthopaedic hospital, Barcelona, Spain 103 participants Trochanteric proximal femoral fractures. Age: mean 84 years % male: 35% Number lost to follow up: not stated
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: 12 months Length of surgery Post-operative transfusion Change in haematocrit Radiographic screening time

	Operative fracture of the femur Later fracture of the femur Cut-out of implant Reoperation Wound infection Wound haematoma Deep vein thrombosis Pneumonia Pressure sores Mortality Mobility Mean time to fracture consolidation
Notes	The outcome of post-operative transfusion was inadequately defined. Mortality at one year was only given as percentages; there was inadequate information to determine if all randomised patients were included in the calculation of these percentages.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Mehdi 2000

Methods	Randomised by sealed envelopes. Surgical experience: No (Reference made to relative inexperience with IMHS at start of trial)
Participants	Orthopaedic hospital, UK 180 participants Extracapsular proximal femoral fractures. Age: mean 76 years % male: unknown Number lost to follow up: 19%
Interventions	Intramedullary hip screw versus Sliding hip screw
Outcomes	Length of follow up: minimum 6 months (mean 13 months, range 6 to 36 months) Length of surgery Operative blood loss Operative fracture of the femur Later fracture of femur (none) Cut-out of implant Peri-operative complication Fracture reduction Wound infection (superficial and deep) Mortality Mobility

Mehdi 2000 (*Continued)*

	Harris hip scores	
Notes	Abstract only published. Unpublished report made available by trialist. Because of the large range of final follow-up times and high and unequal losses to follow up, we decided against presenting final follow-up results (mortality, later fracture and mobility) in the review. Two cases of IMHS required conversion to SHS fixation due to “excessive bowing”.	
Risk of bias		
Item	**Authors’ judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Michos 2001

Methods	Randomised: method not stated Surgical experience: No (Unknown)	
Participants	Orthopaedic hospital, Greece 52 participants Trochanteric proximal femoral fractures. Some may have had subtrochanteric extension. Age: mean 78.5 years % male: unknown Number lost to follow up: not known	
Interventions	Gamma intramedullary nail (“Trochanteric Gamma Nail” used if no subtrochanteric extension)versus Sliding hip screw	
Outcomes	Length of follow up: 3-6 months Operative blood loss Later fracture of the femur Cut-out of implant Non-union Plate detachment Mortality (peri-operative)	
Notes	Abstract only.	
Risk of bias		
Item	**Authors’ judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Miedel 2005

Methods	Randomised by sealed envelopes Surgical experience: No (Half of the operations in each group were by consultant orthopaedic surgeons)
Participants	Orthopaedic hospital, Stockholm, Sweden 217 participants Unstable trochanteric and subtrochanteric proximal femoral fractures. Age: mean 84 years (range 65-99 years) % male: 19% Number lost to follow up: 6 (3%) (at 12 months)
Interventions	Gamma intramedullary nail versus Medoff sliding plate (eight hole Medoff plate used in biaxial dynamisation mode)
Outcomes	Length of follow up: 12 months Length of surgery Operative blood loss Post-operative transfusion Operative fracture of the femur Technical failure Later fracture of the femur Cut-out of implant Displacement (medialisation of the femur requiring surgery) Reoperation Wound infection (superficial and deep) Severe medical complications Length of hospital stay Discharge location Mortality Mobility Pain Hip function Activities of daily living Health related quality of life
Notes	Details of the reoperations removed from the text in the update (issue 1, 2008): All three reoperations, involving total hip replacement, in the Gamma group were for cut-out. Nine reoperations were required in the Medoff group, two (one Girdlestone arthroplasty and one multiple debridements)for sepsis, three (one Girdlestone arthroplasty and two total hip replacement)for cut-out, three (two to intramedullary nails and one to a fixed nail plate with subsequent total hip replacement)for femur displacement (medialisation), and one removal of the Medoff plate due to pain with later revision to a total hip replacement.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Mott 1993

Methods	Randomised using computer-generated random numbers table Surgical experience: No
Participants	Three orthopaedic hospitals, Detroit, USA. 69 participants Trochanteric proximal femoral fractures. Age: mean 76 years (range 19-99 years) % male: 42% Number lost to follow up: not stated
Interventions	Gamma intramedullary nail versus Sliding hip screw
Outcomes	Length of follow up: not stated Length of surgery Operative blood loss Blood transfusion Operative fracture of the femur Later fracture of the femur Cut-out of implant Reoperation Deep wound infection Superficial wound infection Wound haematoma Deep vein thrombosis Myocardial infarction Pneumonia Urinary tract infection Mortality (1 week)
Notes	Trial information supplied by trialists

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

O'Brien 1995

Methods	Blinded randomisation of patients using opaque envelopes Surgical experience: No (Refers to "performance bias" during operation)
Participants	Orthopaedic hospital, Canada. 101 participants 102 trochanteric proximal femoral fractures. Age: mean 80 years (range 39-95 years) % male: 26% Number lost to follow up: 18%

O'Brien 1995 (*Continued)*

Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: average 52 weeks (range 11 to 82 weeks) Length of surgery Blood loss Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union (time to union) Reoperation Wound infection Deep wound infection Wound haematoma Pneumonia Pressure sores Pulmonary embolism Any medical complication Length of hospital stay Mortality Pain at follow up Loss of independence Loss in mobility
Notes	Additional information received from authors. The mortality rate may be higher than that reported because of the number of patients lost to follow up. The number of patients that may have died in the follow-up period is unclear.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Ovesen 2006

Methods	Randomised by consecutively opened sealed opaque envelopes (computer generated sequence) Surgical experience: No (Operations by surgical team on call: 49 surgeons participated in trial)
Participants	Orthopaedic hospital, Odense, Denmark 150 participants with 151 fractures (see Notes) Trochanteric fractures. Age: mean 79 years (range not stated) % male: 28% Number lost to follow up: 17%
Interventions	Trochanteric Gamma intramedullary nail versus Dynamic hip screw

Ovesen 2006 (*Continued)*

Outcomes	Length of follow up: 12 months Length of surgery Blood loss Transfusion Operative fracture of the femur (none) Later fracture of the femur Cut-out of implant Non-union (none) Reoperation Wound infection Medical complications (none) Length of hospital stay Mortality at 12 months Use of walking aids at discharge and 4 months
Notes	Five cases were excluded post-randomisation: 2 wrong diagnosis and 3 transferred out of the hospital catchment area. Extra information supplied by trialists. There were three cases of redislocation of the fracture in which there was major loss of reduction and/or implant position. These cases were included as cases of cut-out.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Pahlpatz 1993

Methods	Randomised: method not stated Surgical experience: No (Unknown: operations by surgical residents with assistance of staff member as required)
Participants	Orthopaedic hospital, Netherlands 113 participants Trochanteric proximal femoral fractures. Age: mean and range - not stated % male: not stated Number lost to follow up: not stated
Interventions	Gamma intramedullary nail versus Sliding hip screw
Outcomes	Length of follow up: 6 months minimum Mortality Failure to regain residential status
Notes	The paper states these are preliminary results of the study and only reports on two outcome measures. No additional results have since been made available.

Pahlpatz 1993 (*Continued)*

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Pajarinen 2005

Methods	Randomised by numbered sealed opaque envelopes; Surgical experience: Yes (Trialist confirmed all surgeons were experienced in both procedures)
Participants	Orthopaedic hospital, Helsinki, Finland 108 participants Trochanteric proximal femoral fracture. Age: mean 81 years % male: 25% Number lost to follow up: 15 (14%)
Interventions	Proximal femoral nail versus Dynamic hip screw
Outcomes	Length of follow up: 4 months Length of surgery Blood loss Units of blood transfused Later fracture of femur Cut-out Failure of fixation (redisplacement) Reoperation Superficial wound infection Deep wound infection Deep vein thrombosis Femoral neck and shaft shortening on X-ray Length of hospital stay Mortality Failure to regain pre-fracture residential status Non recovery of previous mobility
Notes	Additional information supplied by trialists, who also confirmed that the participants of a separately reported radiological study were also ("for most parts of the series") in the trial.

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Papasimos 2005

Methods	Randomised trial: method not stated Surgical experience: No (Unknown)
Participants	Orthopaedic hospital, Patras Hellas, Greece 141 participants Unstable trochanteric proximal femoral fracture (see Notes) Age: mean 81 years % male: 39% Number lost to follow up (of 141): 11 (8%)
Interventions	Proximal femoral nail (PFN) versus Trochanteric Gamma nail versus Sliding hip screw. 11 or 12 mm diameter PFN with distal locking in 37 out of 40 participants. 135 degree Trochanteric Gamma nail with 17 mm proximal diameter and 11 mm distal diameter and distal locking in all participants.
Outcomes	Length of follow up: mean 12 months Length of surgery Operative blood loss Radiographic screening time Operative fracture (some of greater trochanter) Cut-out of implant Later fracture of the femur Non-union Reoperation Superficial wound infection Haematoma Medical complications Chest infection Pneumonia Mental disturbances Deep vein thrombosis Pulmonary embolism Urinary infection Length of hospital stay Time to fracture consolidation Function: Salvati and Wilson score
Notes	There were 141 people randomised into this trial but the intervention groups for the 10 participants who died before one year and the 11 who were lost to follow up were not identified.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Park 1998

Methods	Quasi-randomised according to medical record number Surgical experience: No (Unknown)
Participants	University hospital, Korea 60 participants Intertrochanteric femoral fracture. Age: mean 73 years (all over 60 years) % male: 40% Number lost to follow up: none
Interventions	Gamma AP (Asia-Pacific)intramedullary nail versus Compression hip screw
Outcomes	Length of follow up: mean 18.5 months (range 12 - 31 months) Length of surgery Blood loss Operative fracture of femur (none) Later fracture of femur (greater trochanter) Cut-out of implant Non-union (time to union) Wound infection Varus deformity Patient mobility
Notes	The Gamma AP nail is a modification of the standard Gamma intramedullary nail for use in oriental patients. A request to the trialists for further information including mortality data has been sent.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Pelet 2001

Methods	Randomised by the drawing of lots. Those with an even number drawn received one implant and those with an odd number the other implant. Surgical experience: No (More experience with Gamma nail)
Participants	Orthopaedic hospital, Lausanne, Switzerland 26 participants Trochanteric proximal femoral fractures, classified by the system of Kyle as type IV. These are equivalent to type A3 (AO classification): reversed and transverse fracture lines at the level of the lesser trochanter. Age: mean 71 years (range 21-96 years) % male: 35% Number lost to follow up: none
Interventions	Gamma nail versus the 90 degree blade plate

Pelet 2001 (*Continued)*

Outcomes	Length of follow up: 12 months Length of surgery Operative blood loss Operative fracture of the femur Cut-out Non-union (and time to consolidation) Avascular necrosis Implant failure Reoperation Wound infection Pulmonary embolism Cardiac failure All medical complications Length of hospital stay External rotation deformity Hip flexion Mortality Pain at follow up Use of walking aids Time to start of weight bearing Time to full weight bearing
Notes	Article in French

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Radford 1993

Methods	"Randomised": method not stated Surgical experience: Yes (Gamma nail: personal training and 2 operations before trial; SHS routine; registrar grade and above)
Participants	Orthopaedic hospital, UK 200 participants Trochanteric proximal femoral fractures. Age: mean 80 years (range 60-97 years) % male: 22% Number lost to follow up: not stated
Interventions	Gamma intramedullary nail versus Dynamic hip screw
Outcomes	Length of follow up: 12 months Length of surgery Blood loss

Radford 1993 (*Continued)*

	Operative fracture of the femur Later fracture of the femur Cut-out of implant Non-union Reoperation Wound infection Deep wound infection Deep vein thrombosis Length of hospital stay Mortality Transfer to long term care Mobility level
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Sadowski 2002

Methods	Randomised using computer generated randomised numbers Surgical experience: Yes (All surgeons had performed at least eight of each operation before the study)
Participants	Orthopaedic hospital, Geneva, Switzerland 39 participants Trochanteric proximal femoral fractures, type A3 (AO classification): reversed and transverse fracture lines at the level of the lesser trochanter. Age: mean 79 years % male: 31% Number lost to follow up: none (one patient was unable to attend clinic so had follow up by phone)
Interventions	Proximal femoral nail versus the Dynamic condylar screw
Outcomes	Length of follow up: 12 months Length of surgery Operative blood loss Mean units transfused Number of patients transfused Radiographic screening time Cut-out Non-union (and time to consolidation) Implant failure Reoperation Wound infection Pneumonia

Sadowski 2002 (*Continued*)

	Pressure sores Deep vein thrombosis Pulmonary embolism Urinary infection Cardiac failure/infarction All medical complications Mortality Pain at follow up Social function Transfer to long term care Mobility level
Notes	Additional information supplied by authors This trial was concurrent with the Saudan 2002

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Saudan 2002

Methods	Randomised using computer generated randomised numbers Surgical experience: Yes (All surgeons had performed at least eight of each operation before the study)
Participants	Orthopaedic hospital, Geneva, Switzerland 206 participants Trochanteric proximal femoral fractures, types A1 and A2 (AO classification). Age: mean 83 years % male: 22% Number lost to follow up: 4%
Interventions	Proximal femoral nail versus Dynamic hip screw
Outcomes	Length of follow up: 12 months Length of surgery Operative blood loss Mean units transfused Number of patients transfused Radiographic screening time Cut-out Non-union (and time to consolidation) Implant failure Reoperation Wound infection Pneumonia Pressure sores

Saudan 2002 (*Continued*)

	Deep vein thrombosis Pulmonary embolism Urinary infection Cardiac failure/infarction All medical complications Mortality Pain at follow up Social function Transfer to long term care Mobility level
Notes	Additional information supplied by authors This trial was concurrent with Sadowski 2002.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Utrilla 2005

Methods	Randomised by sealed envelopes, order based on sequence of admission Surgical experience: No (3 prior operations for the nail)
Participants	Orthopaedic hospital, Alicante, Spain 210 participants Trochanteric proximal femoral fractures. No subtrochanteric fractures Age: mean 80 years (range 65-104 years) % male: 31% Number lost to follow up: 7 (3.3%)
Interventions	Gamma intramedullary nail (Trochanteric Gamma Nail version) versus Sliding hip screw
Outcomes	Length of follow up: 12 months Length of surgery Blood transfusion Radiographic screening time Operative fracture of the femur Later fracture of the femur Cut-out of implant Reoperation Deep wound sepsis Local wound healing complications Deep vein thrombosis Shortening Hip flexion Mobility

Utrilla 2005 (*Continued)*

	Pain Mortality at one year	
Notes		
Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

"Surgical experience" in the Methods column gives details of prior experience of the operations the surgeons performed in the trial. "Yes" = 1 in the quality assessment tool (item 5); "No" = 0, which could also reflect a lack of information.
IM: intramedullary
IMHS: intramedullary hip screw
PFN: proximal femoral nail
SHS: sliding hip screw

Characteristics of excluded studies *[ordered by study ID]*

Azzoni 2004	This was a retrospective comparison of 208 people with a trochanteric fracture treated with either an intramedullary nail or a sliding hip screw. The study was excluded because there was no randomisation of patients.
Bhatti 2003	This was a prospective comparison of 70 people treated with either the proximal femoral nail or dynamic hip screw, with the choice of treatment being the preference of the surgeon. It was excluded because it was not a randomised study.
Bienkowski 2006	This was a prospective comparison of 60 people with a trochanteric fracture treated with either a trochanteric femoral nail or a sliding hip screw. The study was excluded because the choice of treatment was according to the preference and experience of the attending surgeon, with no randomisation of patients.
Davison 1996	An interim report of this randomised trial comparing the intramedullary hip screw with the sliding hip screw was reported in a conference abstract published 1996. In 1995, 134 people had been entered in the study. Of the 63 available for clinic review at 6 months, there had been 6 cut-outs in each group. There were no other implant failures or femoral fractures reported. Pain and mobility were similar in both groups. The trial was stated to be continuing but no further results have been presented or made available and correspondence with the author indicated that further information was not available. The study was excluded because it reported only very limited and interim outcomes.
DiCicco 2000	In this study, people with femoral shaft fractures were allocated antegrade or retrograde nailing of femur fracture according to their medical record numbers. All subtrochanteric fractures, which were not included in the quasi-randomised trial, were treated with retrograde nailing. The study was excluded because there was no randomisation of proximal femoral fractures.

(*Continued*)

Fritz 1999	Randomised comparison with 80 people allocated to either the Gamma nail or a gliding nail, which is the same as a gamma nail except the lag screw is changed to a nail. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Hardy 2003	This randomised trial of 80 people with a trochanteric fracture compared the use of a standard intramedullary hip screw against an intramedullary hip screw with a slotted distal locking hole. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Herrera 2002	This was a randomised comparison of 125 people treated with the Gamma nail versus 125 people treated with the proximal femoral nail. It was excluded becuase there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Hogh 1992	This randomised trial from Denmark of 299 cases compared the Gamma nail with the sliding hip screw. The study was reported in conference abstracts only. The results as detailed showed “no difference” in mean operative times, operative blood loss, wound drainage or post-operative haemoglobin levels. Mortality was similar in both groups. Cut-out occurred in six cases in the sliding hip screw group and 10 in the Gamma nail group. There were eight cases in the Gamma nail group of operative or later fracture around the nail. Reoperations were required in six cases in the sliding hip screw group and 12 in the Gamma group. The study was excluded because the exact numbers of cases allocated to each group was not given. Correspondence with medical staff at the trial hospital indicated that no further information was now available.
Kafer 2005	Study, reported in German, comparing the results of 53 people treated with a proximal femoral nail versus 59 people treated with a dynamic hip screw. This study was excluded because there was no randomisation of patients.
Khan 2002	The contact trialist listed in the National Research Register (UK) entry for this study, reported to compare the trochanteric intramedullary nail versus the dynamic compression screw, confirmed that the trial did not “get off the ground”.
Klinger 2005	This was a comparative study of 122 people with unstable trochanteric fractures treated with the proximal femoral nail and 51 treated with the dynamic hip screw with a trochanteric buttress-press plate. It was excluded because it was not a randomised study.
Merenyi 1995	This conference abstract suggested a randomised trial comparing 40 Ender nails with 40 angle plates, and 40 Gamma nails (3 types). Correspondence with the authors indicated that there was no randomisation of patients only a random selection of people who had been previously treated with one of the different implants.
Moran 2000	This was a randomised trial of unstable intertrochanteric fractures comparing the proximal femoral nail and the dynamic hip screw. The trial co-ordinator was Mr CG Morgan, Department of Trauma & Orthopaedics, C Floor, West Block, University Hospital, Nottingham, NG7 2UH, UK. Recruitment to the study was suspended in 1999 due to problems with the proximal femoral nail and no outcome data for the limited number of trial participants has been made available.
Nuber 2003	Study, reported in German, comparing the results of 65 people treated with a proximal femur nail versus 64 people treated with a dynamic hip screw with trochanteric stabilisation plate. This study was excluded when it was confirmed to be a retrospective comparison of two cohorts by Annette Blumle of the German Cochrane Centre.

(*Continued)*

Prinz 1996	Only preliminary results were provided in the conference abstract report of this randomised trial. There were 38 people treated with a sliding hip screw, 43 with a Gamma nail and 41 with an intramedullary hip screw recruited between 01/03/1995 and 01/03/1996. The study was excluded because of the inadequate reporting of the trial outcomes; preliminary results only being available. Should a full report of this ever become available, it is likely that we will reconsider this decision.
Roder 1995	This was a randomised trial of 75 people with stable trochanteric fracture: 25 were treated with a sliding hip screw 25 with a Gamma nail and 25 with a Gamma nail with a modification of the surgical technique using a 4.5 mm drill hole in the lateral femur approximately 5 cm distal to the tip of the nail. The aim was to determine if the drill hole would reduce the risk of bone marrow vascular embolism. The only outcome measure was the degree of marrow embolisation as determined by transoesophageal ultrasound. The results indicated minimal bone marrow embolisation with the SHS and mild embolisation with the Gamma nail inserted with a distal femoral drill hole. For the 25 people treated with the Gamma nail inserted without a drill hole there was heavy bone marrow embolisation as judged by ultrasound. The trial was excluded as: 1. There were no clinical outcomes relevant to this review of SHS versus Gamma nail 2. There was no follow up of trial participants The study is included in the Cochrane review ’ Osteotomy, compression and reaming techniques for internal fixation of extracapsular hip fractures’
Schipper 2004	This was a randomised trial comparing the Gamma nail with the proximal femoral nail in 424 people. It was excluded because there was no extramedullary comparison group, but has been included in the Cochrane review comparing different types of intramedullary nails for extracapsular hip fractures.
Tarantino 2005	This was a two-centre comparison between the Gamma nail versus a variable angle sliding hip screw in 142 people with extracapsular hip fractures. Patients who had undergone fixation with the Gamma nail at one hospital were matched by age, sex and type of fracture to patients treated with a sliding screw device at the other hospital. The study was excluded because there was no randomisation of patients.

Characteristics of ongoing studies *[ordered by study ID]*

Parker

Trial name or title	Randomised trial of Targon intramedullary nail versus sliding hip screw for trochanteric fractures
Methods	
Participants	400 patients with a trochanteric hip fracture which is to be treated surgically
Interventions	Targon intramedullary nail versus Sliding hip screw
Outcomes	Full record of operative and follow-up outcomes until one year from injury with a blinded assessment of outcome
Starting date	2001

Parker (*Continued)*

Contact information	Dr Martyn J Parker, MD, FRCS Orthopaedic Research Fellow Orthopaedic Department Peterborough District Hospital Thorpe Road Peterborough PE3 6DA UK Tel: +44 1733 874000 (bleep 1133) Tel. Secretary: +44 1733 874515 Fax: +44 1733 874111 E-mail: mjparker@doctors.org.uk
Notes	Due to be completed 2008

DATA AND ANALYSES

Comparison 1. Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes) - random-effects model	10	1588	Mean Difference (IV, Random, 95% CI)	3.83 [-1.51, 9.17]
1.1 Gamma nail	6	1045	Mean Difference (IV, Random, 95% CI)	2.48 [-3.60, 8.56]
1.2 Intramedullary hip screw (IMHS)	3	337	Mean Difference (IV, Random, 95% CI)	8.81 [-7.43, 25.05]
1.3 Proximal femoral nail (PFN)	1	206	Mean Difference (IV, Random, 95% CI)	-1.0 [-9.14, 7.14]
1.4 Targon PF nail	0	0	Mean Difference (IV, Random, 95% CI)	Not estimable
2 Operative fracture of the femur	24	3603	Risk Ratio (M-H, Fixed, 95% CI)	3.25 [1.74, 6.08]
2.1 Gamma nail (minus Papasimos 2005, see sub-category 05)	17	2650	Risk Ratio (M-H, Fixed, 95% CI)	3.02 [1.48, 6.14]
2.2 Intramedullary hip screw (IMHS)	5	627	Risk Ratio (M-H, Fixed, 95% CI)	5.01 [1.11, 22.65]
2.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)	1	206	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.4 Targon PF nail	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.5 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	1.52 [0.06, 36.46]
3 Later fracture of the femur	26	3328	Risk Ratio (M-H, Fixed, 95% CI)	5.22 [2.56, 10.64]
3.1 Gamma nail (minus Papasimos 2005, see sub-category 05)	19	2593	Risk Ratio (M-H, Fixed, 95% CI)	5.23 [2.46, 11.14]
3.2 Intramedullary hip screw (IMHS)	4	447	Risk Ratio (M-H, Fixed, 95% CI)	5.12 [0.61, 43.33]
3.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)	1	108	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.5 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Cut-out (overall denominators used)	27	3803	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.80, 1.66]
4.1 Gamma nail (minus Papasimos 2005, see sub-category 05)	19	2792	Risk Ratio (M-H, Fixed, 95% CI)	1.18 [0.77, 1.79]
4.2 Intramedullary hip screw (IMHS)	4	517	Risk Ratio (M-H, Fixed, 95% CI)	0.83 [0.24, 2.84]
4.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	2.07 [0.39, 11.10]

4.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.21, 6.37]
4.5 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.13, 4.31]
5 Non-union (overall denominators used)	14	1781	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.35, 2.42]
5.1 Gamma nail (minus Papasimos 2005, see sub-category 05)	8	1088	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.25, 3.93]
5.2 Intramedullary hip screw (IMHS)	3	307	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.21, 4.95]
5.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)	1	206	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.5 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.03, 7.79]
6 All technical complications of fixation	28	3732	Risk Ratio (M-H, Fixed, 95% CI)	1.97 [1.51, 2.58]
6.1 Gamma nail (minus Papasimos 2005, see sub-category 05)	20	2791	Risk Ratio (M-H, Fixed, 95% CI)	2.03 [1.49, 2.76]
6.2 Intramedullary hip screw (IMHS)	4	447	Risk Ratio (M-H, Fixed, 95% CI)	2.02 [0.93, 4.39]
6.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	1.71 [0.42, 6.99]
6.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.21, 6.37]
6.5 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	1.67 [0.49, 5.72]
7 Reoperation (overall denominators used)	23	3388	Risk Ratio (M-H, Fixed, 95% CI)	1.58 [1.17, 2.12]
7.1 Gamma nail (minus Papasimos 2005, see sub-category 05)	17	2684	Risk Ratio (M-H, Fixed, 95% CI)	1.71 [1.22, 2.40]
7.2 Intramedullary hip screw (IMHS)	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.53 [0.15, 1.88]
7.3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	2.07 [0.64, 6.73]
7.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.21, 6.37]
7.5 Three-group trial results: Gamma nail or PFN	1	120	Risk Ratio (M-H, Fixed, 95% CI)	1.33 [0.37, 4.75]
8 Deep wound infection	18	2595	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.54, 2.17]
8.1 Gamma nail	12	1869	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.46, 2.17]
8.2 Intramedullary hip screw (IMHS)	3	390	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.08]
8.3 Proximal femoral nail (PFN)	2	276	Risk Ratio (M-H, Fixed, 95% CI)	3.38 [0.36, 31.84]
8.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Mortality	23	3123	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.84, 1.12]
9.1 Gamma nail	16	2306	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.81, 1.12]

9.2 Intramedullary hip screw (IMHS)	4	443	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.67, 1.24]
9.3 Proximal femoral nail (PFN)	2	314	Risk Ratio (M-H, Fixed, 95% CI)	1.40 [0.75, 2.62]
9.4 Targon PF nail	1	60	Risk Ratio (M-H, Fixed, 95% CI)	1.53 [0.15, 15.97]
10 Pain at follow up	8	897	Risk Ratio (M-H, Fixed, 95% CI)	1.10 [0.93, 1.30]
10.1 Gamma nail	5	634	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.90, 1.30]
10.2 Intramedullary hip screw (IMHS)	3	263	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.79, 1.75]
10.3 Proximal femoral nail (PFN)	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10.4 Targon PF nail	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
11 Non return to previous residence or dead	9	1070	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.88, 1.16]
11.1 Gamma nail	4	439	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.70, 1.15]
11.2 Intramedullary hip screw (IMHS)	3	330	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.82, 1.33]
11.3 Proximal femoral nail (PFN)	2	301	Risk Ratio (M-H, Fixed, 95% CI)	1.11 [0.89, 1.39]
11.4 Targon PF nail	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 2. Gamma nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes) - random-effects model	6	1045	Mean Difference (IV, Random, 95% CI)	2.48 [-3.60, 8.56]
2 Blood loss (ml) - random-effects model	5	953	Mean Difference (IV, Random, 95% CI)	-29.04 [-73.17, 15.10]
3 Number of people given transfusion - random-effects model	3	756	Risk Ratio (M-H, Random, 95% CI)	1.06 [0.67, 1.68]
4 Radiographic screening time (seconds) - random-effects model	4		Mean Difference (IV, Random, 95% CI)	Totals not selected
5 Operative fracture of femur	18	2730	Risk Ratio (M-H, Fixed, 95% CI)	3.02 [1.51, 6.03]
6 Operative fracture of femur (reported experience with devices)	18	2730	Risk Ratio (M-H, Fixed, 95% CI)	3.02 [1.51, 6.03]
6.1 Experienced surgeon (score = 1)	5	1029	Risk Ratio (M-H, Fixed, 95% CI)	2.71 [0.80, 9.15]
6.2 Not experienced surgeon (score = 0)	11	1412	Risk Ratio (M-H, Fixed, 95% CI)	3.84 [1.45, 10.22]
6.3 Mixed experience (score = 0)	2	289	Risk Ratio (M-H, Fixed, 95% CI)	1.5 [0.26, 8.77]
7 Later fracture of femur	20	2673	Risk Ratio (M-H, Fixed, 95% CI)	5.23 [2.46, 11.14]
8 Cut-out	20	2695	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.76, 1.72]

9 Cut-out (reported experience with devices)	20	2695	Risk Ratio (M-H, Fixed, 95% CI)	1.15 [0.76, 1.72]
9.1 Experienced surgeon (score = 1)	5	964	Risk Ratio (M-H, Fixed, 95% CI)	1.12 [0.54, 2.33]
9.2 Not experienced surgeon (score = 0)	13	1442	Risk Ratio (M-H, Fixed, 95% CI)	1.30 [0.77, 2.19]
9.3 Mixed experience (score = 0)	2	289	Risk Ratio (M-H, Fixed, 95% CI)	0.51 [0.11, 2.28]
10 Cut-out: overall denominators used	20	2872	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.78, 1.76]
11 Non-union	9	1050	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.29, 3.31]
12 Non-union: overall denominators used	9	1168	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.29, 3.40]
13 All technical complications of fixation	21	2871	Risk Ratio (M-H, Fixed, 95% CI)	2.00 [1.48, 2.69]
14 Reoperation	18	2665	Risk Ratio (M-H, Fixed, 95% CI)	1.66 [1.19, 2.31]
15 Reoperation: overall denominators used	18	2764	Risk Ratio (M-H, Fixed, 95% CI)	1.67 [1.20, 2.32]
16 Wound infection or haematoma	17		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
16.1 Wound infection - any type	14	1794	Risk Ratio (M-H, Fixed, 95% CI)	0.97 [0.62, 1.50]
16.2 Deep wound infection	12	1869	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.46, 2.17]
16.3 Wound haematoma	8	819	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.34, 1.79]
17 Pneumonia	9	921	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.47, 1.83]
18 Pressure sore	5	466	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.32, 1.42]
19 Thromboembolic complications	12		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
19.1 Thromboembolic complication	11	1627	Risk Ratio (M-H, Fixed, 95% CI)	1.46 [0.90, 2.36]
19.2 Deep vein thrombosis	10	1506	Risk Ratio (M-H, Fixed, 95% CI)	1.26 [0.77, 2.06]
19.3 Pulmonary embolism	4	401	Risk Ratio (M-H, Fixed, 95% CI)	1.97 [0.50, 7.82]
20 Any medical complication	6	629	Risk Ratio (M-H, Random, 95% CI)	1.13 [0.69, 1.84]
21 Length of hospital stay (days)	5	620	Mean Difference (IV, Fixed, 95% CI)	-0.13 [-1.50, 1.24]
22 Anatomical deformity	8		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
22.1 Shortening of leg	3	335	Risk Ratio (M-H, Fixed, 95% CI)	0.46 [0.21, 1.03]
22.2 Varus deformity	5	679	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.34, 1.37]
22.3 External rotational deformity	2	229	Risk Ratio (M-H, Fixed, 95% CI)	1.09 [0.28, 4.19]
23 Mortality	16	2306	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.81, 1.12]
24 Mortality (allocation concealment: Cochrane rating A,B,C)	16	2306	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.81, 1.12]
24.1 Allocation concealment: A (fully concealed)	3	314	Risk Ratio (M-H, Fixed, 95% CI)	2.01 [0.94, 4.33]
24.2 Allocation concealment: B (unknown)	7	1343	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.74, 1.10]
24.3 Allocation concealment: C (not concealed)	6	649	Risk Ratio (M-H, Fixed, 95% CI)	0.93 [0.66, 1.31]
25 Pain at follow up	5	634	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.90, 1.30]
26 Non-return to previous residence	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

26.1 Non-return to previous residence (survivors)	3	189	Risk Ratio (M-H, Fixed, 95% CI)	0.71 [0.39, 1.31]
26.2 Non-return to previous residence or dead	4	439	Risk Ratio (M-H, Fixed, 95% CI)	0.90 [0.70, 1.15]
27 Impaired walking	8		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
27.1 Impaired walking	8	984	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.89, 1.10]
27.2 Impaired walking (overall denominators used)	8	1311	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.89, 1.13]
28 Reoperation - subgrouped by type of Gamma nail	18	2665	Risk Ratio (M-H, Fixed, 95% CI)	1.66 [1.19, 2.31]
28.1 Gamma 1 nail	15	2276	Risk Ratio (M-H, Fixed, 95% CI)	1.80 [1.24, 2.62]
28.2 Trochanteric Gamma nail	3	389	Risk Ratio (M-H, Fixed, 95% CI)	1.23 [0.61, 2.47]

Comparison 3. Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes) - random-effects model	3	337	Mean Difference (IV, Random, 95% CI)	8.81 [-7.43, 25.05]
2 Blood loss (ml)	2	235	Mean Difference (IV, Fixed, 95% CI)	-62.42 [-98.56, -26.28]
3 Transfusion (units of red cells) - random-effects model	2	235	Mean Difference (IV, Random, 95% CI)	-0.00 [-0.68, 0.67]
4 Number of patients transfused	1	102	Risk Ratio (M-H, Fixed, 95% CI)	0.85 [0.52, 1.39]
5 Radiographic screening time (minutes)	2	237	Mean Difference (IV, Fixed, 95% CI)	1.15 [0.83, 1.47]
6 Fracture fixation complications	5		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Operative fracture of femur	5	627	Risk Ratio (M-H, Fixed, 95% CI)	5.01 [1.11, 22.65]
6.2 Later fracture of femur	4	447	Risk Ratio (M-H, Fixed, 95% CI)	5.12 [0.61, 43.33]
6.3 Cut-out	4	517	Risk Ratio (M-H, Fixed, 95% CI)	0.83 [0.24, 2.84]
6.4 Non-union	3	307	Risk Ratio (M-H, Fixed, 95% CI)	1.02 [0.21, 4.95]
6.5 Detachment of the plate from the femur	1	102	Risk Ratio (M-H, Fixed, 95% CI)	0.35 [0.01, 8.31]
6.6 All technical complications of fixation	4	447	Risk Ratio (M-H, Fixed, 95% CI)	2.02 [0.93, 4.39]
6.7 Reoperation	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.53 [0.15, 1.88]
7 Wound infection or haematoma	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
7.1 Wound infection - any type	3	390	Risk Ratio (M-H, Fixed, 95% CI)	0.4 [0.08, 2.01]
7.2 Deep wound infection	3	390	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.08]
7.3 Wound haematoma	3	345	Risk Ratio (M-H, Fixed, 95% CI)	1.47 [0.54, 4.02]
8 Post-operative complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
8.1 Mortality	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.35, 2.83]
8.2 Thromboembolic complication	1	100	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.05, 5.34]
8.3 Deep vein thrombosis	2	210	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.17, 5.62]

8.4 Pulmonary embolism	1	100	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.99]
8.5 Major medical complication	2	245	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.64, 2.10]
9 Length of hospital stay (days)	2	237	Mean Difference (IV, Fixed, 95% CI)	1.00 [-1.37, 3.37]
10 Mean limb shortening (cm)	1	64	Mean Difference (IV, Fixed, 95% CI)	-0.70 [-1.13, -0.27]
11 Final outcome measures	4		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
11.1 Mortality	4	443	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.67, 1.24]
11.2 Pain	3	263	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.79, 1.75]
11.3 Failure to return home (survivors)	3	256	Risk Ratio (M-H, Fixed, 95% CI)	1.16 [0.78, 1.73]
11.4 Failure to return home or dead	3	330	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.82, 1.33]
11.5 Failure to return home or dead (overall denominators used)	3	341	Risk Ratio (M-H, Fixed, 95% CI)	1.00 [0.79, 1.28]
11.6 Failure to regain mobility	1	105	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.53, 1.73]
11.7 Poor mobility	1	88	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.48, 1.35]

Comparison 4. Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Blood loss and transfusion	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2.2 Transfusion (units of red blood cells)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5 Fracture fixation complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Operative fracture femur	1	80	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Later fracture of femur	2	188	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.3 Cut-out	3	356	Risk Ratio (M-H, Fixed, 95% CI)	1.31 [0.36, 4.75]
5.4 Cut-out: overall denominators used	3	394	Risk Ratio (M-H, Fixed, 95% CI)	1.28 [0.35, 4.67]
5.5 Non-union	2	248	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 7.95]
5.6 All technical complications of fixation	3	394	Risk Ratio (M-H, Fixed, 95% CI)	1.86 [0.71, 4.85]
5.7 Reoperation	3	356	Risk Ratio (M-H, Fixed, 95% CI)	1.94 [0.80, 4.71]
5.8 Reoperation: overall denominators used	3	394	Risk Ratio (M-H, Fixed, 95% CI)	1.90 [0.78, 4.62]
6 Wound infection or haematoma	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Superficial wound infection	2	188	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 15.44]
6.2 Deep wound infection	2	276	Risk Ratio (M-H, Fixed, 95% CI)	3.38 [0.36, 31.84]
6.3 Haematoma	1	80	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.21, 4.66]
7 Post-operative complications	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

7.1 Pneumonia	2	286	Risk Ratio (M-H, Fixed, 95% CI)	1.06 [0.39, 2.91]
7.2 Pressure sores	1	206	Risk Ratio (M-H, Fixed, 95% CI)	0.80 [0.18, 3.46]
7.3 Deep vein thrombosis	3	394	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.12, 3.98]
7.4 Pulmonary embolism	2	286	Risk Ratio (M-H, Fixed, 95% CI)	0.68 [0.12, 3.98]
7.5 Urinary tract infection	2	286	Risk Ratio (M-H, Fixed, 95% CI)	1.48 [0.95, 2.30]
7.6 Any medical complication	1	206	Risk Ratio (M-H, Fixed, 95% CI)	1.12 [0.85, 1.49]
8 Length of hospital stay (days)	2	314	Mean Difference (IV, Fixed, 95% CI)	0.27 [-0.76, 1.30]
9 Final outcome measures	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Mortality at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Mortality at 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.3 In nursing home at 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.4 In nursing home or dead at 1 year	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.5 In nursing home or dead at 1 year (overall denominators used)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.6 Failure to regain pre-fracture residential status at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.7 Failure to regain pre-fracture residential status, seriously ill or dead at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.8 Failure to recover previous mobility at 4 months	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.9 Failure to recover previous mobility or dead at 4 months (overall denominators used)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 5. Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Later fracture of the femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.2 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 Non-union	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.4 All technical complications of fixation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.5 Reoperation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 All wound infections	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Post-operative compiications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.2 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 6. Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Operative details	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
1.2 Operative blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
1.3 Total blood loss (ml)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
1.4 Radiographic screening time (seconds)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Time to radiographic healing (weeks)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4 Time to effective weight bearing (weeks)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only

Comparison 7. Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Fracture fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
1.1 Cut-out	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.2 All fixation complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 Reoperation	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2 Wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Superficial wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
2.2 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Post-operative complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
3.1 Thromboembolic complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.2 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.3 Pressure sores	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3.4 All medical complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4 Anatomical deformity	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.1 Leg shortening	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.2 Varus deformity	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
4.3 External rotation deformity	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Final outcome measures	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5.1 Mortality	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Failure to regain pre-fracture mobility	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.3 Death or failure to regain pre-fracture mobility	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 8. Femoral nail (2 types) versus Medoff sliding plate

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Proximal femoral nail (PFN)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Operative blood loss (mls)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2.1 Proximal femoral nail (PFN)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
3 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Proximal femoral nail (PFN)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 Operative fracture of the femur	2	420	Risk Ratio (M-H, Fixed, 95% CI)	4.84 [0.57, 40.81]
4.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	6.94 [0.36, 132.70]
4.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	2.80 [0.12, 67.98]
5 Later fracture of femur	2	420	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
6 Cut-out	2	420	Risk Ratio (M-H, Fixed, 95% CI)	1.44 [0.52, 4.01]
6.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.74 [0.17, 3.24]
6.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	2.8 [0.58, 13.55]
7 Non-union	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
7.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
8 All technical complications of fixation	2	420	Risk Ratio (M-H, Fixed, 95% CI)	1.23 [0.57, 2.65]
8.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.85 [0.29, 2.45]
8.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	1.87 [0.58, 6.00]
9 Reoperation	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
9.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.09, 1.19]
9.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	8.4 [1.08, 65.09]
10 Wound infection - any type	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
10.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.25 [0.05, 1.14]
10.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	3.73 [0.81, 17.15]
11 Deep wound infection	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
11.1 Gamma nail	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
12 Wound haematoma	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
12.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
13 Severe medical complications	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
13.1 Gamma nail	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
14 Mortality at 1 year	2	420	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.53, 1.12]

14.1 Gamma nail	1	217	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.48, 1.22]
14.2 Proximal femoral nail (PFN)	1	203	Risk Ratio (M-H, Fixed, 95% CI)	0.78 [0.42, 1.46]
15 Inability to walk 15 metres at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
15.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
16 Inability to rise from a chair at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
16.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
17 Inability to climb a curb at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
17.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
18 Need to use walking aids at one year	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
18.1 Proximal femoral nail (PFN)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

Comparison 9. Femoral nail (2 types) versus condylar or blade plate

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Length of surgery (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
2 Number of patients transfused	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
2.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
3 Radiographic screening time (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
4 Operative fracture of femur	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
4.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
5 Cut-out	2	65	Risk Ratio (M-H, Fixed, 95% CI)	0.32 [0.07, 1.53]
5.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	0.09 [0.01, 1.47]
5.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	3.0 [0.13, 67.51]
6 Non-union	2	61	Risk Ratio (M-H, Fixed, 95% CI)	0.42 [0.06, 2.69]

6.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1	35	Risk Ratio (M-H, Fixed, 95% CI)	0.94 [0.06, 13.93]
6.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	0.2 [0.01, 3.80]
7 All technical complications of fixation	2	61	Risk Ratio (M-H, Fixed, 95% CI)	0.23 [0.07, 0.71]
7.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1	35	Risk Ratio (M-H, Fixed, 95% CI)	0.13 [0.02, 0.98]
7.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	0.33 [0.08, 1.36]
8 Reoperation	2	65	Risk Ratio (M-H, Fixed, 95% CI)	0.07 [0.00, 1.22]
8.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	0.07 [0.00, 1.22]
8.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9 Deep wound infection	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
9.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
9.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
10 Pneumonia	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
10.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
11 Pressure sores	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
11.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
12 Deep vein thrombosis	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
12.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
13 Pulmonary embolism	2		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
13.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
13.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
14 All medical complications	2	65	Risk Ratio (M-H, Fixed, 95% CI)	1.20 [0.69, 2.06]
14.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	1.22 [0.57, 2.62]
14.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	1.17 [0.54, 2.53]
15 Length of hospital stay (days)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

15.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Mean Difference (IV, Fixed, 95% CI)	Not estimable
16 Mortality (1 year)	2	65	Risk Ratio (M-H, Fixed, 95% CI)	1.9 [0.19, 19.27]
16.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1	39	Risk Ratio (M-H, Fixed, 95% CI)	1.9 [0.19, 19.27]
16.2 Gamma nail versus 90 degree blade plate	1	26	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
17 Pain at follow up	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
17.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
18 In nursing home at one year from injury	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
18.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
19 In nursing home or dead at one year from injury	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
19.1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
20 Use of walking aids	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
20.2 Gamma nail versus 90 degree blade plate	1		Risk Ratio (M-H, Fixed, 95% CI)	Not estimable

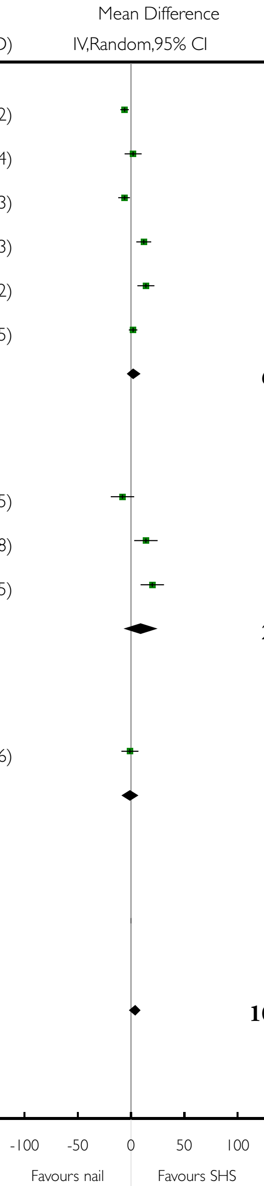
Analysis 1.1. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes) - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes) - random-effects model

Study or subgroup	Short femoral nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Weight	Mean Difference IV,Random,95% CI
1 Gamma nail						
Adams 2001	203	55.4 (20)	197	61.3 (22.2)	11.9 %	-5.90 [-10.04, -1.76]
Hoffman 1996	31	56.7 (17)	36	54.3 (16.4)	9.9 %	2.40 [-5.63, 10.43]
Kukla 1997	60	47.1 (20.8)	60	53.4 (8.3)	11.2 %	-6.30 [-11.97, -0.63]
O'Brien 1995	53	59 (23.9)	49	47 (13.3)	10.2 %	12.00 [4.57, 19.43]
Ovesen 2006	73	65 (29)	73	51 (22)	9.7 %	14.00 [5.65, 22.35]
Utrilla 2005	104	46 (11)	106	44 (15)	12.1 %	2.00 [-1.55, 5.55]
Subtotal (95% CI)	**524**		**521**		**65.0 %**	**2.48 [-3.60, 8.56]**
Heterogeneity: Tau² = 47.36; Chi² = 34.80, df = 5 (P<0.00001); I² =86%						
Test for overall effect: Z = 0.80 (P = 0.42)						
2 Intramedullary hip screw (IMHS)						
Baumgaertner 1998	67	72 (33)	68	80 (35)	8.0 %	-8.00 [-19.47, 3.47]
Hardy 1998	50	71 (28.9)	50	57 (24.8)	8.5 %	14.00 [3.44, 24.56]
Harrington 2002	50	108 (26.8)	52	88 (27.5)	8.5 %	20.00 [9.46, 30.54]
Subtotal (95% CI)	**167**		**170**		**25.1 %**	**8.81 [-7.43, 25.05]**
Heterogeneity: Tau² = 175.30; Chi² = 13.45, df = 2 (P = 0.001); I² =85%						
Test for overall effect: Z = 1.06 (P = 0.29)						
3 Proximal femoral nail (PFN)						
Saudan 2002	100	64 (33)	106	65 (26)	9.9 %	-1.00 [-9.14, 7.14]
Subtotal (95% CI)	**100**		**106**		**9.9 %**	**-1.00 [-9.14, 7.14]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.24 (P = 0.81)						
4 Targon PF nail						
Subtotal (95% CI)	**0**		**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Heterogeneity: not applicable						
Test for overall effect: not applicable						
Total (95% CI)	**791**		**797**		**100.0 %**	**3.83 [-1.51, 9.17]**
Heterogeneity: Tau² = 58.02; Chi² = 56.04, df = 9 (P<0.00001); I² =84%						
Test for overall effect: Z = 1.41 (P = 0.16)						



Analysis 1.2. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 2 Operative fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 2 Operative fracture of the femur

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 05)				
Adams 2001	1/203	0/197		2.91 [0.12, 71.05]
Ahrengart 1994	0/105	1/104		0.33 [0.01, 8.01]
Benum 1994	4/226	0/234		9.32 [0.50, 172.07]
Bridle 1991	1/49	0/51		3.12 [0.13, 74.80]
Goldhagen 1994	0/36	0/39		0.0 [0.0, 0.0]
Guyer 1991	1/50	0/50		3.00 [0.13, 71.92]
Hoffman 1996	1/31	0/36		3.47 [0.15, 82.21]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Kuwabara 1998	0/20	0/23		0.0 [0.0, 0.0]
Leung 1992	3/93	2/93		1.50 [0.26, 8.77]
Marques Lopez 2002	0/43	0/60		0.0 [0.0, 0.0]
Mott 1993	3/35	0/34		6.81 [0.36, 127.00]
O'Brien 1995	2/53	0/49		4.63 [0.23, 94.10]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Radford 1993	6/100	1/100		6.00 [0.74, 48.94]
Utrilla 2005	4/104	2/106		2.04 [0.38, 10.89]
Subtotal (95% CI)	**1311**	**1339**		**3.02 [1.48, 6.14]**
Total events: 26 (Short femoral nail), 6 (Sliding hip screw)				
Heterogeneity: Chi^2 = 4.03, df = 10 (P = 0.95); I^2 =0.0%				
Test for overall effect: Z = 3.05 (P = 0.0023)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	2/67	0/68		5.07 [0.25, 103.74]
Hardy 1998	3/50	0/50		7.00 [0.37, 132.10]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Hoffmann 1999	2/56	0/54		4.82 [0.24, 98.24]

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

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Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Mehdi 2000	0/90	0/90		0.0 [0.0, 0.0]
Subtotal (95% CI)	**313**	**314**		**5.01 [1.11, 22.65]**
Total events: 8 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.14$, df = 3 (P = 0.99); $I^2 = 0.0\%$				
Test for overall effect: Z = 2.09 (P = 0.036)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)				
Saudan 2002	0/100	0/106		0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**106**		**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
4 Targon PF nail				
Subtotal (95% CI)	**0**	**0**		**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: not applicable				
5 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	1/80	0/40		1.52 [0.06, 36.46]
Subtotal (95% CI)	**80**	**40**		**1.52 [0.06, 36.46]**
Total events: 1 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.26 (P = 0.80)				
Total (95% CI)	**1804**	**1799**		**3.25 [1.74, 6.08]**
Total events: 35 (Short femoral nail), 6 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 4.78$, df = 15 (P = 0.99); $I^2 = 0.0\%$				
Test for overall effect: Z = 3.70 (P = 0.00022)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

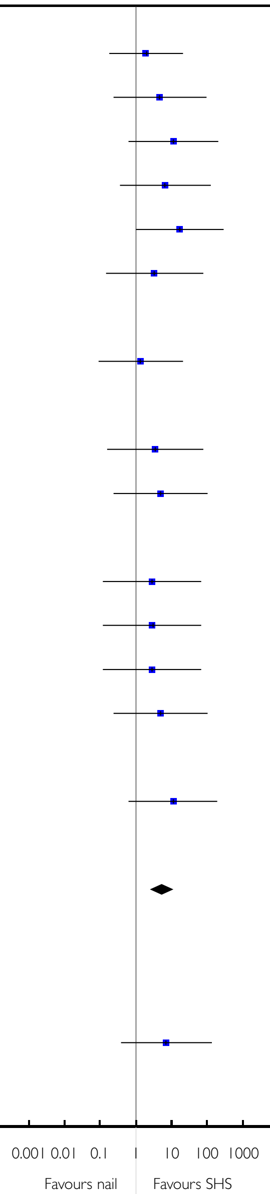
Analysis 1.3. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 3 Later fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 3 Later fracture of the femur

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 05)				
Adams 2001	2/203	1/197		1.94 [0.18, 21.23]
Ahrengart 1994	2/87	0/81		4.66 [0.23, 95.61]
Benum 1994	5/226	0/234		11.39 [0.63, 204.76]
Bridle 1991	3/34	0/32		6.60 [0.35, 122.96]
Butt 1995	8/47	0/48		17.35 [1.03, 292.39]
Goldhagen 1994	1/36	0/39		3.24 [0.14, 77.15]
Guyer 1991	0/50	0/50		0.0 [0.0, 0.0]
Hoffman 1996	1/23	1/31		1.35 [0.09, 20.44]
Kukla 1997	0/45	0/44		0.0 [0.0, 0.0]
Kuwabara 1998	1/20	0/23		3.43 [0.15, 79.74]
Leung 1992	2/93	0/93		5.00 [0.24, 102.75]
Marques Lopez 2002	0/30	0/38		0.0 [0.0, 0.0]
Michos 2001	1/25	0/24		2.88 [0.12, 67.53]
Mott 1993	1/35	0/34		2.92 [0.12, 69.20]
O'Brien 1995	1/53	0/49		2.78 [0.12, 66.62]
Ovesen 2006	2/73	0/73		5.00 [0.24, 102.38]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Radford 1993	5/100	0/100		11.00 [0.62, 196.33]
Utrilla 2005	0/82	0/81		0.0 [0.0, 0.0]
Subtotal (95% CI)	**1292**	**1301**		**5.23 [2.46, 11.14]**
Total events: 35 (Short femoral nail), 2 (Sliding hip screw)				
Heterogeneity: Chi^2 = 3.45, df = 13 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 4.29 (P = 0.000018)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	3/67	0/68		7.10 [0.37, 134.92]
Hardy 1998	0/50	0/50		0.0 [0.0, 0.0]



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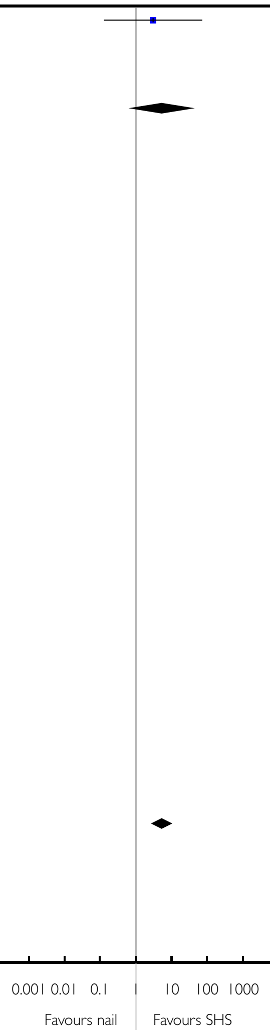
Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Subtotal (95% CI)	**223**	**224**		**5.12 [0.61, 43.33]**
Total events: 4 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.14$, df = 1 (P = 0.71); I^2 =0.0%				
Test for overall effect: Z = 1.50 (P = 0.13)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Subtotal (95% CI)	**54**	**54**		**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
4 Targon PF nail				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
Subtotal (95% CI)	**34**	**26**		**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
5 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	0/80	0/40		0.0 [0.0, 0.0]
Subtotal (95% CI)	**80**	**40**		**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**1683**	**1645**		**5.22 [2.56, 10.64]**
Total events: 39 (Short femoral nail), 2 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 3.59$, df = 15 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 4.55 (P < 0.00001)				



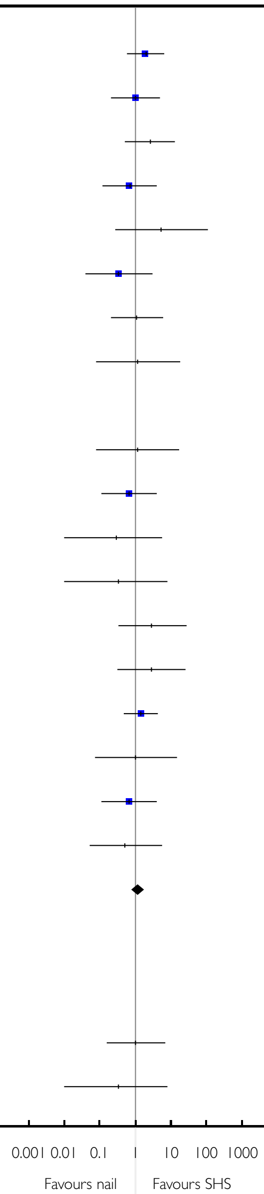
Analysis 1.4. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 4 Cut-out (overall denominators used).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 4 Cut-out (overall denominators used)

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 05)				
Adams 2001	8/203	4/197		1.94 [0.59, 6.34]
Ahrengart 1994	3/105	3/104		0.99 [0.20, 4.80]
Benum 1994	5/226	2/234		2.59 [0.51, 13.21]
Bridle 1991	2/49	3/51		0.69 [0.12, 3.98]
Goldhagen 1994	2/36	0/39		5.41 [0.27, 108.93]
Guyer 1991	1/50	3/50		0.33 [0.04, 3.10]
Haynes 1996	2/19	3/31		1.09 [0.20, 5.93]
Hoffman 1996	1/31	1/36		1.16 [0.08, 17.80]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Kuwabara 1998	1/20	1/23		1.15 [0.08, 17.22]
Leung 1992	2/113	3/113		0.67 [0.11, 3.91]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Michos 2001	0/26	1/26		0.33 [0.01, 7.82]
Mott 1993	3/35	1/34		2.91 [0.32, 26.66]
O'Brien 1995	3/53	1/49		2.77 [0.30, 25.78]
Ovesen 2006	7/73	5/73		1.40 [0.47, 4.21]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Radford 1993	2/100	3/100		0.67 [0.11, 3.90]
Utrilla 2005	1/104	2/106		0.51 [0.05, 5.53]
Subtotal (95% CI)	**1376**	**1416**		**1.18 [0.77, 1.79]**
Total events: 44 (Short femoral nail), 39 (Sliding hip screw)				
Heterogeneity: Chi^2 = 8.30, df = 17 (P = 0.96); I^2 =0.0%				
Test for overall effect: Z = 0.76 (P = 0.45)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	2/67	2/68		1.01 [0.15, 7.00]
Hardy 1998	0/50	1/50		0.33 [0.01, 7.99]



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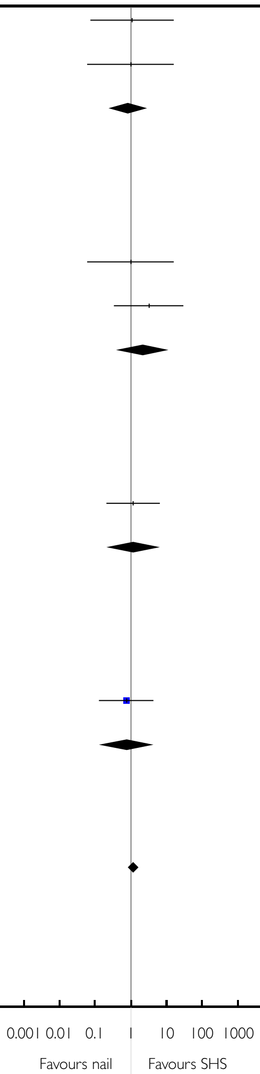
Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Harrington 2002	1/50	1/52		1.04 [0.07, 16.18]
Mehdi 2000	1/90	1/90		1.00 [0.06, 15.74]
Subtotal (95% CI)	**257**	**260**		**0.83 [0.24, 2.84]**
Total events: 4 (Short femoral nail), 5 (Sliding hip screw)				
Heterogeneity: Chi^2 = 0.40, df = 3 (P = 0.94); I^2 =0.0%				
Test for overall effect: Z = 0.30 (P = 0.77)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)				
Pajarinen 2005	1/54	1/54		1.00 [0.06, 15.58]
Saudan 2002	3/100	1/106		3.18 [0.34, 30.07]
Subtotal (95% CI)	**154**	**160**		**2.07 [0.39, 11.10]**
Total events: 4 (Short femoral nail), 2 (Sliding hip screw)				
Heterogeneity: Chi^2 = 0.41, df = 1 (P = 0.52); I^2 =0.0%				
Test for overall effect: Z = 0.85 (P = 0.39)				
4 Targon PF nail				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]
Subtotal (95% CI)	**34**	**26**		**1.15 [0.21, 6.37]**
Total events: 3 (Short femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.16 (P = 0.88)				
5 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	3/80	2/40		0.75 [0.13, 4.31]
Subtotal (95% CI)	**80**	**40**		**0.75 [0.13, 4.31]**
Total events: 3 (Short femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.32 (P = 0.75)				
Total (95% CI)	**1901**	**1902**		**1.15 [0.80, 1.66]**
Total events: 58 (Short femoral nail), 50 (Sliding hip screw)				
Heterogeneity: Chi^2 = 9.95, df = 25 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.75 (P = 0.45)				



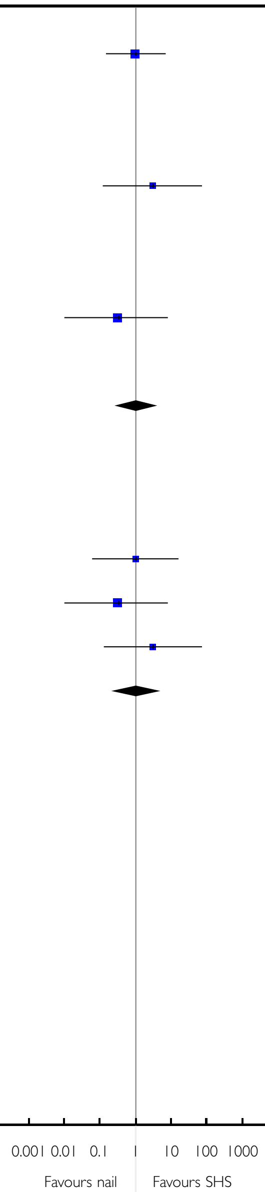
Analysis 1.5. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 5 Non-union (overall denominators used).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 5 Non-union (overall denominators used)

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 05)			
Ahrengart 1994	2/105	2/104	0.99 [0.14, 6.90]
Goldhagen 1994	0/36	0/39	0.0 [0.0, 0.0]
Kukla 1997	0/60	0/60	0.0 [0.0, 0.0]
Leung 1992	1/113	0/113	3.00 [0.12, 72.87]
Michos 2001	0/26	0/26	0.0 [0.0, 0.0]
Ovesen 2006	0/73	0/73	0.0 [0.0, 0.0]
Park 1998	0/30	1/30	0.33 [0.01, 7.87]
Radford 1993	0/100	0/100	0.0 [0.0, 0.0]
Subtotal (95% CI)	**543**	**545**	**1.00 [0.25, 3.93]**
Total events: 3 (Short femoral nail), 3 (Sliding hip screw)			
Heterogeneity: $Chi^2 = 0.92$, df = 2 (P = 0.63); I^2 =0.0%			
Test for overall effect: Z = 0.01 (P = 0.99)			
2 Intramedullary hip screw (IMHS)			
Baumgaertner 1998	1/67	1/68	1.01 [0.06, 15.90]
Hardy 1998	0/35	1/35	0.33 [0.01, 7.91]
Harrington 2002	1/50	0/52	3.12 [0.13, 74.78]
Subtotal (95% CI)	**152**	**155**	**1.02 [0.21, 4.95]**
Total events: 2 (Short femoral nail), 2 (Sliding hip screw)			
Heterogeneity: $Chi^2 = 0.95$, df = 2 (P = 0.62); I^2 =0.0%			
Test for overall effect: Z = 0.02 (P = 0.98)			
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)			
Saudan 2002	0/100	0/106	0.0 [0.0, 0.0]
Subtotal (95% CI)	**100**	**106**	**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)			
Heterogeneity: not applicable			
Test for overall effect: Z = 0.0 (P < 0.00001)			
4 Targon PF nail			
Giraud 2005	0/34	0/26	0.0 [0.0, 0.0]
Subtotal (95% CI)	**34**	**26**	**0.0 [0.0, 0.0]**



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Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
5 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	1/80	1/40		0.50 [0.03, 7.79]
Subtotal (95% CI)	**80**	**40**		**0.50 [0.03, 7.79]**
Total events: 1 (Short femoral nail), 1 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.49 (P = 0.62)				
Total (95% CI)	**909**	**872**		**0.92 [0.35, 2.42]**
Total events: 6 (Short femoral nail), 6 (Sliding hip screw)				
Heterogeneity: Chi^2 = 2.09, df = 6 (P = 0.91); I^2 =0.0%				
Test for overall effect: Z = 0.16 (P = 0.87)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

Analysis 1.6. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 6 All technical complications of fixation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 6 All technical complications of fixation

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 05)				
Adams 2001	11/203	7/197		1.52 [0.60, 3.85]
Ahrengart 1994	7/105	6/104		1.16 [0.40, 3.32]
Benum 1994	14/226	2/234		7.25 [1.67, 31.53]
Bridle 1991	7/49	3/51		2.43 [0.67, 8.86]
Butt 1995	11/47	3/48		3.74 [1.11, 12.58]
Goldhagen 1994	3/36	0/39		7.57 [0.40, 141.62]
Guyer 1991	3/50	3/50		1.00 [0.21, 4.72]
Haynes 1996	3/18	3/23		1.28 [0.29, 5.59]

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

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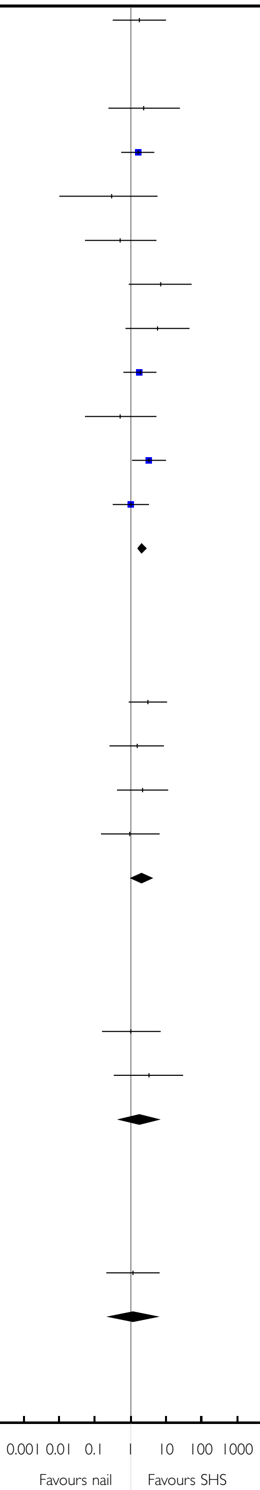
Study or subgroup	Short femoral nail	Sliding hip screw	Risk Ratio	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI	M-H,Fixed,95% CI
Hoffman 1996	3/31	2/36		1.74 [0.31, 9.76]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Kuwabara 1998	2/20	1/23		2.30 [0.23, 23.51]
Leung 1992	8/93	5/93		1.60 [0.54, 4.71]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Michos 2001	1/26	2/26		0.50 [0.05, 5.18]
Mott 1993	7/35	1/34		6.80 [0.88, 52.37]
O'Brien 1995	6/53	1/49		5.55 [0.69, 44.45]
Ovesen 2006	9/73	5/73		1.80 [0.63, 5.11]
Park 1998	1/30	2/30		0.50 [0.05, 5.22]
Radford 1993	13/100	4/100		3.25 [1.10, 9.63]
Utrilla 2005	5/82	5/81		0.99 [0.30, 3.28]
Subtotal (95% CI)	**1380**	**1411**		**2.03 [1.49, 2.76]**
Total events: 114 (Short femoral nail), 57 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 16.40$, df = 18 (P = 0.56); I^2 =0.0%				
Test for overall effect: Z = 4.52 (P < 0.00001)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	9/67	3/68		3.04 [0.86, 10.76]
Hardy 1998	3/50	2/50		1.50 [0.26, 8.60]
Harrington 2002	4/50	2/52		2.08 [0.40, 10.86]
Hoffmann 1999	2/56	2/54		0.96 [0.14, 6.60]
Subtotal (95% CI)	**223**	**224**		**2.02 [0.93, 4.39]**
Total events: 18 (Short femoral nail), 9 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 1.09$, df = 3 (P = 0.78); I^2 =0.0%				
Test for overall effect: Z = 1.77 (P = 0.076)				
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)				
Pajarinen 2005	2/54	2/54		1.00 [0.15, 6.84]
Saudan 2002	3/100	1/106		3.18 [0.34, 30.07]
Subtotal (95% CI)	**154**	**160**		**1.71 [0.42, 6.99]**
Total events: 5 (Short femoral nail), 3 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.59$, df = 1 (P = 0.44); I^2 =0.0%				
Test for overall effect: Z = 0.75 (P = 0.45)				
4 Targon PF nail				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]
Subtotal (95% CI)	**34**	**26**		**1.15 [0.21, 6.37]**
Total events: 3 (Short femoral nail), 2 (Sliding hip screw)				
Heterogeneity: not applicable				



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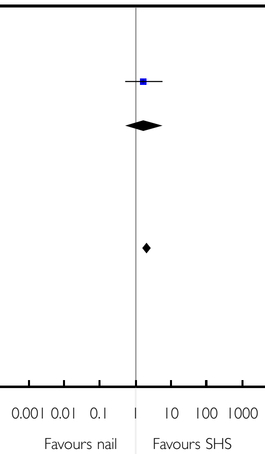
Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.16 (P = 0.88)				
5 Three-group trial results: Gamma nail or PFN				
Papasimos 2005	10/80	3/40		1.67 [0.49, 5.72]
Subtotal (95% CI)	**80**	**40**		**1.67 [0.49, 5.72]**
Total events: 10 (Short femoral nail), 3 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.81 (P = 0.42)				
Total (95% CI)	**1871**	**1861**		**1.97 [1.51, 2.58]**
Total events: 150 (Short femoral nail), 74 (Sliding hip screw)				
Heterogeneity: Chi^2 = 18.45, df = 26 (P = 0.86); I^2 =0.0%				
Test for overall effect: Z = 4.94 (P < 0.00001)				



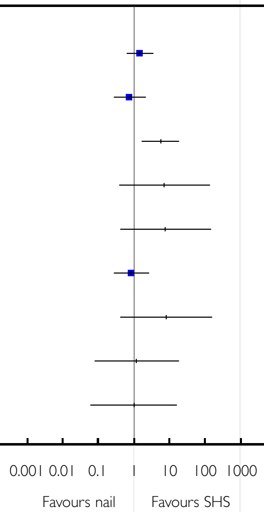
Analysis 1.7. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 7 Reoperation (overall denominators used).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 7 Reoperation (overall denominators used)

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail (minus Papasimos 2005, see sub-category 05)					
Adams 2001	12/203	8/197		12.1 %	1.46 [0.61, 3.48]
Ahrengart 1994	6/105	8/104		12.0 %	0.74 [0.27, 2.07]
Benum 1994	16/226	3/234		4.4 %	5.52 [1.63, 18.69]
Butt 1995	3/47	0/48		0.7 %	7.15 [0.38, 134.67]
Goldhagen 1994	3/36	0/39		0.7 %	7.57 [0.40, 141.62]
Guyer 1991	5/50	6/50		9.0 %	0.83 [0.27, 2.55]
Haynes 1996	2/19	0/31		0.6 %	8.00 [0.40, 158.22]
Hoffman 1996	1/31	1/36		1.4 %	1.16 [0.08, 17.80]
Kukla 1997	1/60	1/60		1.5 %	1.00 [0.06, 15.62]



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Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Leung 1992	4/113	2/113		3.0 %	2.00 [0.37, 10.70]
Marques Lopez 2002	2/43	4/60		5.0 %	0.70 [0.13, 3.64]
Michos 2001	1/26	1/26		1.5 %	1.00 [0.07, 15.15]
Mott 1993	3/35	0/34		0.8 %	6.81 [0.36, 127.00]
O'Brien 1995	5/53	2/49		3.1 %	2.31 [0.47, 11.37]
Ovesen 2006	12/73	6/73		9.0 %	2.00 [0.79, 5.04]
Radford 1993	6/100	3/100		4.5 %	2.00 [0.51, 7.78]
Utrilla 2005	1/104	4/106		5.9 %	0.25 [0.03, 2.24]
Subtotal (95% CI)	**1324**	**1360**		**75.0 %**	**1.71 [1.22, 2.40]**
Total events: 83 (Short femoral nail), 49 (Sliding hip screw)					
Heterogeneity: Chi^2 = 16.38, df = 16 (P = 0.43); I^2 =2%					
Test for overall effect: Z = 3.11 (P = 0.0018)					
2 Intramedullary hip screw (IMHS)					
Hoffmann 1999	0/56	2/54		3.8 %	0.19 [0.01, 3.93]
Hardy 1998	3/50	4/50		6.0 %	0.75 [0.18, 3.18]
Subtotal (95% CI)	**106**	**104**		**9.8 %**	**0.53 [0.15, 1.88]**
Total events: 3 (Short femoral nail), 6 (Sliding hip screw)					
Heterogeneity: Chi^2 = 0.65, df = 1 (P = 0.42); I^2 =0.0%					
Test for overall effect: Z = 0.98 (P = 0.33)					
3 Proximal femoral nail (PFN) (minus Papasimos 2005, see sub-category 05)					
Pajarinen 2005	2/54	2/54		3.0 %	1.00 [0.15, 6.84]
Saudan 2002	6/100	2/106		2.9 %	3.18 [0.66, 15.39]
Subtotal (95% CI)	**154**	**160**		**5.9 %**	**2.07 [0.64, 6.73]**
Total events: 8 (Short femoral nail), 4 (Sliding hip screw)					
Heterogeneity: Chi^2 = 0.83, df = 1 (P = 0.36); I^2 =0.0%					
Test for overall effect: Z = 1.22 (P = 0.22)					
4 Targon PF nail					
Giraud 2005	3/34	2/26		3.4 %	1.15 [0.21, 6.37]
Subtotal (95% CI)	**34**	**26**		**3.4 %**	**1.15 [0.21, 6.37]**
Total events: 3 (Short femoral nail), 2 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.16 (P = 0.88)					
5 Three-group trial results: Gamma nail or PFN					
Papasimos 2005	8/80	3/40		6.0 %	1.33 [0.37, 4.75]
Subtotal (95% CI)	**80**	**40**		**6.0 %**	**1.33 [0.37, 4.75]**
Total events: 8 (Short femoral nail), 3 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.44 (P = 0.66)					
Total (95% CI)	**1698**	**1690**		**100.0 %**	**1.58 [1.17, 2.12]**

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Favours nail Favours SHS

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Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 105 (Short femoral nail), 64 (Sliding hip screw)					
Heterogeneity: Chi^2 = 20.25, df = 22 (P = 0.57); I^2 =0.0%					
Test for overall effect: Z = 2.99 (P = 0.0027)					

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

Analysis 1.8. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 8 Deep wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 8 Deep wound infection

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Adams 2001	3/203	2/197		1.46 [0.25, 8.62]
Ahrengart 1994	0/105	1/104		0.33 [0.01, 8.01]
Guyer 1991	0/50	1/50		0.33 [0.01, 7.99]
Hoffman 1996	0/31	0/36		0.0 [0.0, 0.0]
Kukla 1997	2/60	0/60		5.00 [0.25, 102.00]
Leung 1992	1/93	3/93		0.33 [0.04, 3.15]
Mott 1993	0/35	0/34		0.0 [0.0, 0.0]
O'Brien 1995	0/53	0/49		0.0 [0.0, 0.0]
Ovesen 2006	2/73	1/73		2.00 [0.19, 21.58]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Radford 1993	1/100	0/100		3.00 [0.12, 72.77]
Utrilla 2005	0/104	1/106		0.34 [0.01, 8.24]
Subtotal (95% CI)	**937**	**932**		**0.99 [0.46, 2.17]**
Total events: 10 (Short femoral nail), 10 (Sliding hip screw)				
Heterogeneity: Chi^2 = 4.33, df = 8 (P = 0.83); I^2 =0.0%				
Test for overall effect: Z = 0.01 (P = 0.99)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

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Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
2 Intramedullary hip screw (IMHS)				
Hardy 1998	0/50	0/50		0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54		0.0 [0.0, 0.0]
Mehdi 2000	0/90	1/90		0.33 [0.01, 8.08]
Subtotal (95% CI)	**196**	**194**		**0.33 [0.01, 8.08]**
Total events: 0 (Short femoral nail), 1 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.68 (P = 0.50)				
3 Proximal femoral nail (PFN)				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Saudan 2002	3/79	1/89		3.38 [0.36, 31.84]
Subtotal (95% CI)	**133**	**143**		**3.38 [0.36, 31.84]**
Total events: 3 (Short femoral nail), 1 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 1.06 (P = 0.29)				
4 Targon PF nail				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
Subtotal (95% CI)	**34**	**26**		**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**1300**	**1295**		**1.08 [0.54, 2.17]**
Total events: 13 (Short femoral nail), 12 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 5.89$, df = 10 (P = 0.82); I^2 =0.0%				
Test for overall effect: Z = 0.21 (P = 0.83)				

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

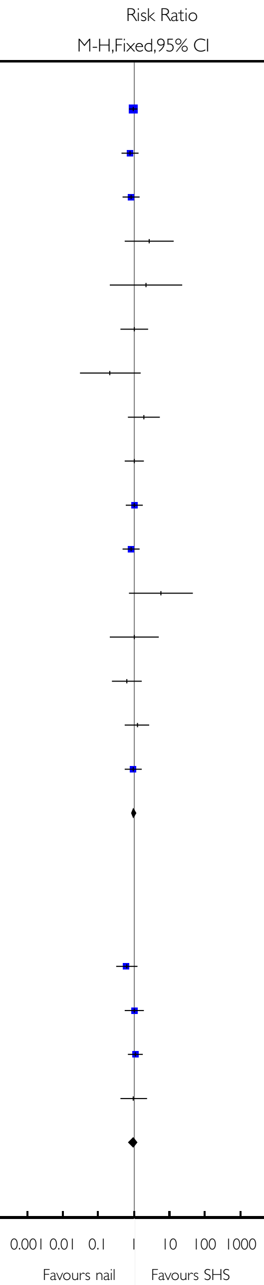
Analysis 1.9. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 9 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 9 Mortality

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Adams 2001	59/203	61/197	20.8 %	0.94 [0.70, 1.27]
Ahrengart 1994	18/105	23/104	7.8 %	0.78 [0.45, 1.35]
Bridle 1991	15/49	19/51	6.3 %	0.82 [0.47, 1.43]
Butt 1995	5/47	2/48	0.7 %	2.55 [0.52, 12.52]
Goldhagen 1994	2/36	1/39	0.3 %	2.17 [0.21, 22.89]
Guyer 1991	8/50	8/50	2.7 %	1.00 [0.41, 2.46]
Haynes 1996	1/19	8/31	2.0 %	0.20 [0.03, 1.51]
Hoffman 1996	8/31	5/36	1.6 %	1.86 [0.68, 5.10]
Kukla 1997	14/60	14/60	4.7 %	1.00 [0.52, 1.91]
Leung 1992	20/113	20/113	6.7 %	1.00 [0.57, 1.75]
Marques Lopez 2002	13/43	22/60	6.2 %	0.82 [0.47, 1.45]
O'Brien 1995	6/52	1/49	0.3 %	5.65 [0.71, 45.29]
Ovesen 2006	3/73	3/73	1.0 %	1.00 [0.21, 4.79]
Pahlpatz 1993	6/51	10/53	3.3 %	0.62 [0.24, 1.59]
Radford 1993	12/100	10/100	3.4 %	1.20 [0.54, 2.65]
Utrilla 2005	19/104	21/106	7.0 %	0.92 [0.53, 1.61]
Subtotal (95% CI)	**1136**	**1170**	**74.7 %**	**0.95 [0.81, 1.12]**
Total events: 209 (Short femoral nail), 228 (Sliding hip screw)				
Heterogeneity: Chi^2 = 10.99, df = 15 (P = 0.75); I^2 =0.0%				
Test for overall effect: Z = 0.59 (P = 0.56)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	10/65	17/66	5.7 %	0.60 [0.30, 1.21]
Hardy 1998	15/50	15/50	5.0 %	1.00 [0.55, 1.82]
Harrington 2002	20/50	19/52	6.3 %	1.09 [0.67, 1.79]
Hoffmann 1999	9/56	9/54	3.1 %	0.96 [0.41, 2.24]
Subtotal (95% CI)	**221**	**222**	**20.0 %**	**0.91 [0.67, 1.24]**
Total events: 54 (Short femoral nail), 60 (Sliding hip screw)				



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Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Heterogeneity: Chi^2 = 2.03, df = 3 (P = 0.57); I^2 =0.0%					
Test for overall effect: Z = 0.59 (P = 0.55)					
3 Proximal femoral nail (PFN)					
Pajarinen 2005	4/54	2/54		0.7 %	2.00 [0.38, 10.47]
Saudan 2002	16/100	13/106		4.2 %	1.30 [0.66, 2.57]
Subtotal (95% CI)	**154**	**160**		**4.9 %**	**1.40 [0.75, 2.62]**
Total events: 20 (Short femoral nail), 15 (Sliding hip screw)					
Heterogeneity: Chi^2 = 0.22, df = 1 (P = 0.64); I^2 =0.0%					
Test for overall effect: Z = 1.05 (P = 0.29)					
4 Targon PF nail					
Giraud 2005	2/34	1/26		0.4 %	1.53 [0.15, 15.97]
Subtotal (95% CI)	**34**	**26**		**0.4 %**	**1.53 [0.15, 15.97]**
Total events: 2 (Short femoral nail), 1 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.36 (P = 0.72)					
Total (95% CI)	**1545**	**1578**		**100.0 %**	**0.97 [0.84, 1.12]**
Total events: 285 (Short femoral nail), 304 (Sliding hip screw)					
Heterogeneity: Chi^2 = 14.77, df = 22 (P = 0.87); I^2 =0.0%					
Test for overall effect: Z = 0.45 (P = 0.65)					

0.001 0.01 0.1 1 10 100 1000

Favours nail Favours SHS

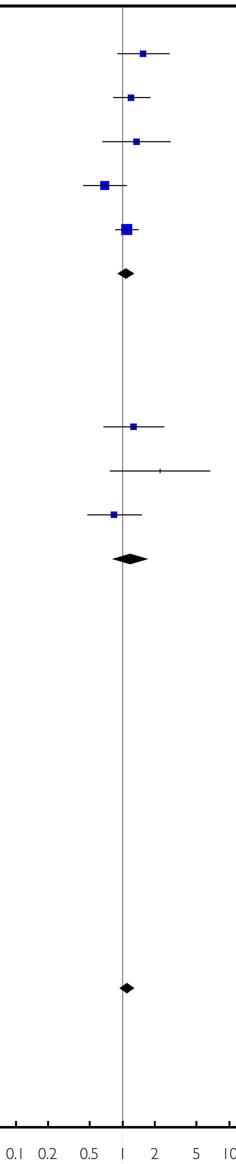
Analysis 1.10. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 10 Pain at follow up.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 10 Pain at follow up

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Ahrengart 1994	25/88	15/83		10.3 %	1.57 [0.89, 2.77]
Guyer 1991	19/28	18/32		11.2 %	1.21 [0.81, 1.80]
Hoffman 1996	9/23	9/31		5.1 %	1.35 [0.64, 2.85]
Leung 1992	22/93	32/93		21.4 %	0.69 [0.43, 1.09]
Utrilla 2005	50/82	45/81		30.3 %	1.10 [0.85, 1.42]
Subtotal (95% CI)	**314**	**320**		**78.4 %**	**1.08 [0.90, 1.30]**
Total events: 125 (Short femoral nail), 119 (Sliding hip screw)					
Heterogeneity: $Chi^2 = 6.03$, df = 4 (P = 0.20); $I^2 = 34\%$					
Test for overall effect: Z = 0.81 (P = 0.42)					
2 Intramedullary hip screw (IMHS)					
Baumgaertner 1998	15/52	12/53		8.0 %	1.27 [0.66, 2.45]
Hardy 1998	9/35	4/35		2.7 %	2.25 [0.76, 6.63]
Hoffmann 1999	14/45	16/43		11.0 %	0.84 [0.47, 1.50]
Subtotal (95% CI)	**132**	**131**		**21.6 %**	**1.17 [0.79, 1.75]**
Total events: 38 (Short femoral nail), 32 (Sliding hip screw)					
Heterogeneity: $Chi^2 = 2.75$, df = 2 (P = 0.25); $I^2 = 27\%$					
Test for overall effect: Z = 0.78 (P = 0.43)					
3 Proximal femoral nail (PFN)					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
4 Targon PF nail					
Subtotal (95% CI)	**0**	**0**		**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**446**	**451**		**100.0 %**	**1.10 [0.93, 1.30]**
Total events: 163 (Short femoral nail), 151 (Sliding hip screw)					
Heterogeneity: $Chi^2 = 8.75$, df = 7 (P = 0.27); $I^2 = 20\%$					
Test for overall effect: Z = 1.10 (P = 0.27)					



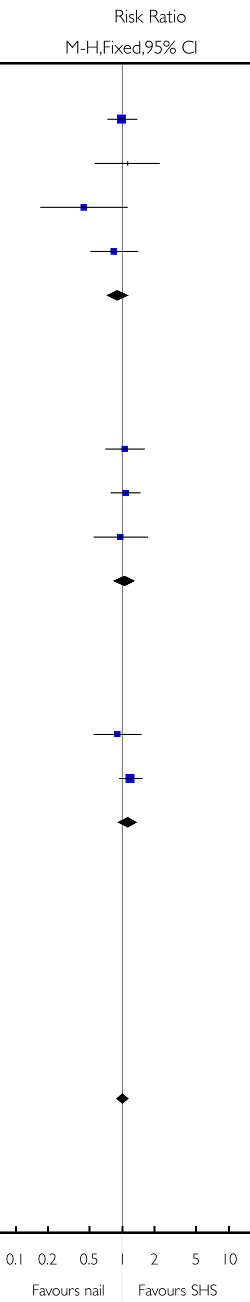
Analysis 1.11. Comparison 1 Femoral nail (4 types) versus sliding hip screw (SHS), Outcome 11 Non return to previous residence or dead.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 1 Femoral nail (4 types) versus sliding hip screw (SHS)

Outcome: 11 Non return to previous residence or dead

Study or subgroup	Short femoral nail n/N	Sliding hip screw n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Ahrengart 1994	43/105	43/104	19.2 %	0.99 [0.72, 1.37]
Guyer 1991	11/36	11/40	4.6 %	1.11 [0.55, 2.25]
Haynes 1996	4/19	15/31	5.1 %	0.44 [0.17, 1.12]
Pahlpatz 1993	17/51	21/53	9.1 %	0.84 [0.50, 1.40]
Subtotal (95% CI)	**211**	**228**	**38.0 %**	**0.90 [0.70, 1.15]**
Total events: 75 (Short femoral nail), 90 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 3.04$, df = 3 (P = 0.39); I^2 =1%				
Test for overall effect: Z = 0.88 (P = 0.38)				
2 Intramedullary hip screw (IMHS)				
Baumgaertner 1998	24/58	25/64	10.6 %	1.06 [0.69, 1.63]
Harrington 2002	31/50	30/52	13.1 %	1.07 [0.78, 1.48]
Hoffmann 1999	16/54	16/52	7.2 %	0.96 [0.54, 1.72]
Subtotal (95% CI)	**162**	**168**	**30.8 %**	**1.04 [0.82, 1.33]**
Total events: 71 (Short femoral nail), 71 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 0.11$, df = 2 (P = 0.95); I^2 =0.0%				
Test for overall effect: Z = 0.34 (P = 0.73)				
3 Proximal femoral nail (PFN)				
Pajarinen 2005	18/52	20/52	8.9 %	0.90 [0.54, 1.50]
Saudan 2002	58/95	52/102	22.3 %	1.20 [0.93, 1.54]
Subtotal (95% CI)	**147**	**154**	**31.1 %**	**1.11 [0.89, 1.39]**
Total events: 76 (Short femoral nail), 72 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 1.01$, df = 1 (P = 0.32); I^2 =1%				
Test for overall effect: Z = 0.93 (P = 0.35)				
4 Targon PF nail				
Subtotal (95% CI)	**0**	**0**	**0.0 %**	**0.0 [0.0, 0.0]**
Total events: 0 (Short femoral nail), 0 (Sliding hip screw)				
Heterogeneity: not applicable				
Test for overall effect: not applicable				
Total (95% CI)	**520**	**550**	**100.0 %**	**1.01 [0.88, 1.16]**
Total events: 222 (Short femoral nail), 233 (Sliding hip screw)				
Heterogeneity: $Chi^2 = 5.87$, df = 8 (P = 0.66); I^2 =0.0%				
Test for overall effect: Z = 0.12 (P = 0.90)				



Analysis 2.1. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes) - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

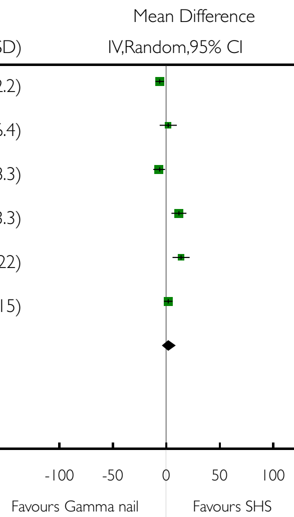
Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes) - random-effects model

Study or subgroup	Gamma nail N	Mean(SD)	SHS N	Mean(SD)	Weight	Mean Difference IV,Random,95% CI
Adams 2001	203	55.4 (20)	197	61.3 (22.2)	18.5 %	-5.90 [-10.04, -1.76]
Hoffman 1996	31	56.7 (17)	36	54.3 (16.4)	15.0 %	2.40 [-5.63, 10.43]
Kukla 1997	60	47.1 (20.8)	60	53.4 (8.3)	17.3 %	-6.30 [-11.97, -0.63]
O'Brien 1995	53	59 (23.9)	49	47 (13.3)	15.6 %	12.00 [4.57, 19.43]
Ovesen 2006	73	65 (29)	73	51 (22)	14.7 %	14.00 [5.65, 22.35]
Utrilla 2005	104	46 (11)	106	44 (15)	19.0 %	2.00 [-1.55, 5.55]
Total (95% CI)	**524**		**521**		**100.0 %**	**2.48 [-3.60, 8.56]**

Heterogeneity: $Tau^2 = 47.36$; $Chi^2 = 34.80$, df = 5 ($P<0.00001$); $I^2 = 86\%$

Test for overall effect: Z = 0.80 (P = 0.42)



Analysis 2.2. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 2 Blood loss (ml) - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

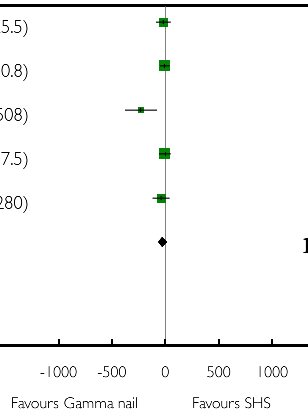
Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 2 Blood loss (ml) - random-effects model

Study or subgroup	Gamma nail N	Mean(SD)	SHS N	Mean(SD)	Weight	Mean Difference IV,Random,95% CI
Adams 2001	203	244.4 (384.9)	197	260.4 (325.5)	20.3 %	-16.00 [-85.78, 53.78]
Kukla 1997	60	152.3 (130.7)	60	160.3 (110.8)	29.5 %	-8.00 [-51.36, 35.36]
Leung 1992	93	814 (548)	93	1043 (508)	7.0 %	-229.00 [-380.87, -77.13]
O'Brien 1995	52	258.7 (145.4)	49	259.2 (137.5)	25.1 %	-0.50 [-55.67, 54.67]
Ovesen 2006	73	240 (190)	73	280 (280)	18.1 %	-40.00 [-117.62, 37.62]
Total (95% CI)	**481**		**472**		**100.0 %**	**-29.04 [-73.17, 15.10]**

Heterogeneity: Tau^2 = 1230.33; Chi^2 = 8.31, df = 4 (P = 0.08); I^2 =52%

Test for overall effect: Z = 1.29 (P = 0.20)



Analysis 2.3. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 3 Number of people given transfusion - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

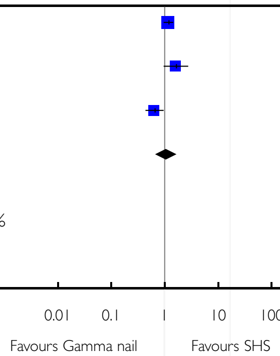
Outcome: 3 Number of people given transfusion - random-effects model

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Random,95% CI
Adams 2001	108/203	88/197	39.7 %	1.19 [0.97, 1.46]
Ovesen 2006	26/73	16/73	27.4 %	1.63 [0.95, 2.77]
Utrilla 2005	28/104	44/106	32.9 %	0.65 [0.44, 0.96]
Total (95% CI)	**380**	**376**	**100.0 %**	**1.06 [0.67, 1.68]**

Total events: 162 (Gamma nail), 148 (SHS)

Heterogeneity: Tau^2 = 0.13; Chi^2 = 9.77, df = 2 (P = 0.01); I^2 =80%

Test for overall effect: Z = 0.25 (P = 0.80)



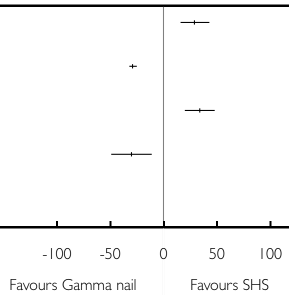
Analysis 2.4. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 4 Radiographic screening time (seconds) - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 4 Radiographic screening time (seconds) - random-effects model

Study or subgroup	Gamma nail N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
Hoffman 1996	31	70.2 (33.6)	36	40.8 (21)		29.40 [15.73, 43.07]
Leung 1992	93	38.2 (8.7)	93	66.9 (13.7)		-28.70 [-32.00, -25.40]
O'Brien 1995	48	60 (46.2)	43	26 (18)		34.00 [19.87, 48.13]
Utrilla 2005	104	132 (72)	106	162 (72)		-30.00 [-49.48, -10.52]



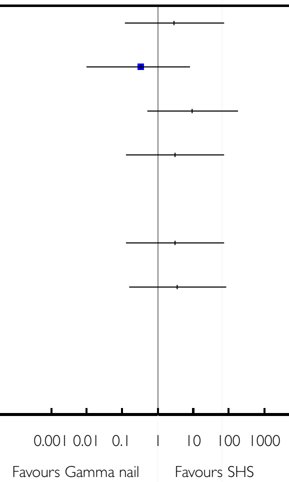
Analysis 2.5. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 5 Operative fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 5 Operative fracture of femur

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Adams 2001	1/203	0/197		2.91 [0.12, 71.05]
Ahrengart 1994	0/105	1/104		0.33 [0.01, 8.01]
Benum 1994	4/226	0/234		9.32 [0.50, 172.07]
Bridle 1991	1/49	0/51		3.12 [0.13, 74.80]
Goldhagen 1994	0/36	0/39		0.0 [0.0, 0.0]
Guyer 1991	1/50	0/50		3.00 [0.13, 71.92]
Hoffman 1996	1/31	0/36		3.47 [0.15, 82.21]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
Kuwabara 1998	0/20	0/23		0.0 [0.0, 0.0]



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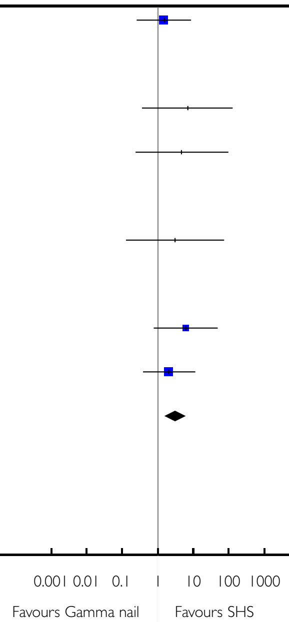
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Leung 1992	3/93	2/93		1.50 [0.26, 8.77]
Marques Lopez 2002	0/43	0/60		0.0 [0.0, 0.0]
Mott 1993	3/35	0/34		6.81 [0.36, 127.00]
O'Brien 1995	2/53	0/49		4.63 [0.23, 94.10]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]
Papasimos 2005	1/40	0/40		3.00 [0.13, 71.51]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Radford 1993	6/100	1/100		6.00 [0.74, 48.94]
Utrilla 2005	4/104	2/106		2.04 [0.38, 10.89]
Total (95% CI)	**1351**	**1379**		**3.02 [1.51, 6.03]**

Total events: 27 (Gamma nail), 6 (SHS)

Heterogeneity: $Chi^2 = 4.03$, df = 11 (P = 0.97); $I^2 = 0.0\%$

Test for overall effect: Z = 3.13 (P = 0.0018)



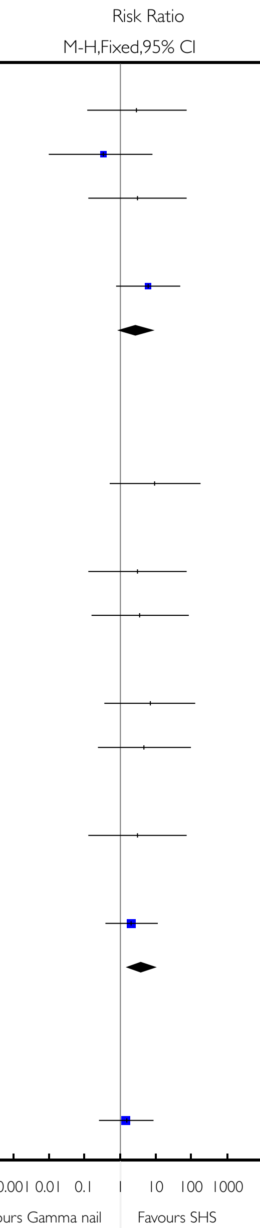
Analysis 2.6. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 6 Operative fracture of femur (reported experience with devices).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 6 Operative fracture of femur (reported experience with devices)

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Experienced surgeon (score = 1)			
Adams 2001	1/203	0/197	2.91 [0.12, 71.05]
Ahrengart 1994	0/105	1/104	0.33 [0.01, 8.01]
Bridle 1991	1/49	0/51	3.12 [0.13, 74.80]
Kukla 1997	0/60	0/60	0.0 [0.0, 0.0]
Radford 1993	6/100	1/100	6.00 [0.74, 48.94]
Subtotal (95% CI)	**517**	**512**	**2.71 [0.80, 9.15]**
Total events: 8 (Gamma nail), 2 (SHS)			
Heterogeneity: Chi^2 = 2.23, df = 3 (P = 0.53); I^2 =0.0%			
Test for overall effect: Z = 1.61 (P = 0.11)			
2 Not experienced surgeon (score = 0)			
Benum 1994	4/226	0/234	9.32 [0.50, 172.07]
Goldhagen 1994	0/36	0/39	0.0 [0.0, 0.0]
Guyer 1991	1/50	0/50	3.00 [0.13, 71.92]
Hoffman 1996	1/31	0/36	3.47 [0.15, 82.21]
Kuwabara 1998	0/20	0/23	0.0 [0.0, 0.0]
Mott 1993	3/35	0/34	6.81 [0.36, 127.00]
O'Brien 1995	2/53	0/49	4.63 [0.23, 94.10]
Ovesen 2006	0/73	0/73	0.0 [0.0, 0.0]
Papasimos 2005	1/40	0/40	3.00 [0.13, 71.51]
Park 1998	0/30	0/30	0.0 [0.0, 0.0]
Utrilla 2005	4/104	2/106	2.04 [0.38, 10.89]
Subtotal (95% CI)	**698**	**714**	**3.84 [1.45, 10.22]**
Total events: 16 (Gamma nail), 2 (SHS)			
Heterogeneity: Chi^2 = 1.12, df = 6 (P = 0.98); I^2 =0.0%			
Test for overall effect: Z = 2.70 (P = 0.0069)			
3 Mixed experience (score = 0)			
Leung 1992	3/93	2/93	1.50 [0.26, 8.77]



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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Marques Lopez 2002	0/43	0/60		0.0 [0.0, 0.0]
Subtotal (95% CI)	**136**	**153**		**1.50 [0.26, 8.77]**
Total events: 3 (Gamma nail), 2 (SHS)				
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.45 (P = 0.65)				
Total (95% CI)	**1351**	**1379**		**3.02 [1.51, 6.03]**
Total events: 27 (Gamma nail), 6 (SHS)				
Heterogeneity: $Chi^2 = 4.03$, df = 11 (P = 0.97); $I^2 = 0.0\%$				
Test for overall effect: Z = 3.13 (P = 0.0018)				

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.7. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 7 Later fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 7 Later fracture of femur

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Adams 2001	2/203	1/197		1.94 [0.18, 21.23]
Ahrengart 1994	2/87	0/81		4.66 [0.23, 95.61]
Benum 1994	5/226	0/234		11.39 [0.63, 204.76]
Bridle 1991	3/34	0/32		6.60 [0.35, 122.96]
Butt 1995	8/47	0/48		17.35 [1.03, 292.39]
Goldhagen 1994	1/36	0/39		3.24 [0.14, 77.15]
Guyer 1991	0/50	0/50		0.0 [0.0, 0.0]
Hoffman 1996	1/23	1/31		1.35 [0.09, 20.44]
Kukla 1997	0/45	0/44		0.0 [0.0, 0.0]
Kuwabara 1998	1/20	0/23		3.43 [0.15, 79.74]
Leung 1992	2/93	0/93		5.00 [0.24, 102.75]
Marques Lopez 2002	0/30	0/38		0.0 [0.0, 0.0]

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

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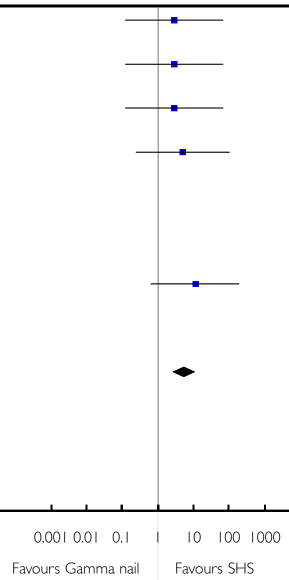
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Michos 2001	1/25	0/24		2.88 [0.12, 67.53]
Mott 1993	1/35	0/34		2.92 [0.12, 69.20]
O'Brien 1995	1/53	0/49		2.78 [0.12, 66.62]
Ovesen 2006	2/73	0/73		5.00 [0.24, 102.38]
Papasimos 2005	0/40	0/40		0.0 [0.0, 0.0]
Park 1998	0/30	0/30		0.0 [0.0, 0.0]
Radford 1993	5/100	0/100		11.00 [0.62, 196.33]
Utrilla 2005	0/82	0/81		0.0 [0.0, 0.0]
Total (95% CI)	**1332**	**1341**		**5.23 [2.46, 11.14]**

Total events: 35 (Gamma nail), 2 (SHS)

Heterogeneity: $Chi^2 = 3.45$, df = 13 (P = 1.00); $I^2 = 0.0\%$

Test for overall effect: Z = 4.29 (P = 0.000018)



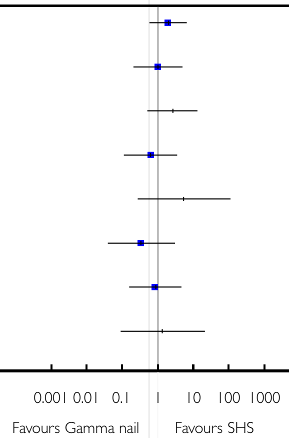
Analysis 2.8. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 8 Cut-out.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 8 Cut-out

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Adams 2001	8/203	4/197		1.94 [0.59, 6.34]
Ahrengart 1994	3/105	3/104		0.99 [0.20, 4.80]
Benum 1994	5/226	2/234		2.59 [0.51, 13.21]
Bridle 1991	2/34	3/32		0.63 [0.11, 3.51]
Goldhagen 1994	2/36	0/39		5.41 [0.27, 108.93]
Guyer 1991	1/50	3/50		0.33 [0.04, 3.10]
Haynes 1996	2/18	3/23		0.85 [0.16, 4.57]
Hoffman 1996	1/23	1/31		1.35 [0.09, 20.44]



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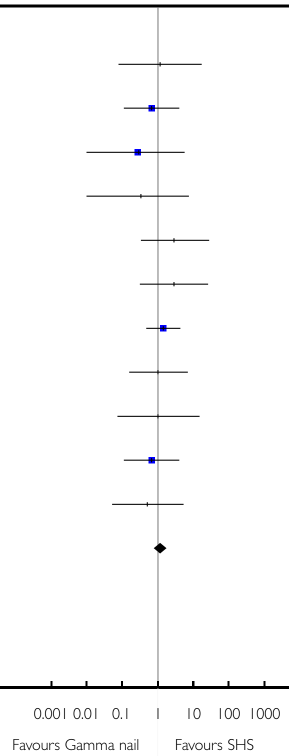
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Kukla 1997	0/45	0/44		0.0 [0.0, 0.0]
Kuwabara 1998	1/20	1/23		1.15 [0.08, 17.22]
Leung 1992	2/93	3/93		0.67 [0.11, 3.90]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Michos 2001	0/25	1/24		0.32 [0.01, 7.50]
Mott 1993	3/35	1/34		2.91 [0.32, 26.66]
O'Brien 1995	3/53	1/49		2.77 [0.30, 25.78]
Ovesen 2006	7/73	5/73		1.40 [0.47, 4.21]
Papasimos 2005	2/40	2/40		1.00 [0.15, 6.76]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Radford 1993	2/100	3/100		0.67 [0.11, 3.90]
Utrilla 2005	1/82	2/81		0.49 [0.05, 5.34]
Total (95% CI)	**1334**	**1361**		**1.15 [0.76, 1.72]**

Total events: 46 (Gamma nail), 41 (SHS)

Heterogeneity: Chi^2 = 8.69, df = 18 (P = 0.97); I^2 =0.0%

Test for overall effect: Z = 0.66 (P = 0.51)



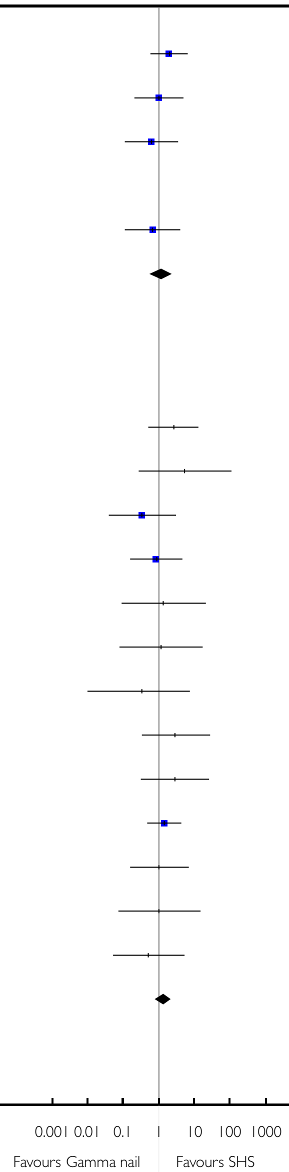
Analysis 2.9. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 9 Cut-out (reported experience with devices).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 9 Cut-out (reported experience with devices)

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Experienced surgeon (score = 1)			
Adams 2001	8/203	4/197	1.94 [0.59, 6.34]
Ahrengart 1994	3/105	3/104	0.99 [0.20, 4.80]
Bridle 1991	2/34	3/32	0.63 [0.11, 3.51]
Kukla 1997	0/45	0/44	0.0 [0.0, 0.0]
Radford 1993	2/100	3/100	0.67 [0.11, 3.90]
Subtotal (95% CI)	**487**	**477**	**1.12 [0.54, 2.33]**
Total events: 15 (Gamma nail), 13 (SHS)			
Heterogeneity: Chi^2 = 1.62, df = 3 (P = 0.66); I^2 =0.0%			
Test for overall effect: Z = 0.32 (P = 0.75)			
2 Not experienced surgeon (score = 0)			
Benum 1994	5/226	2/234	2.59 [0.51, 13.21]
Goldhagen 1994	2/36	0/39	5.41 [0.27, 108.93]
Guyer 1991	1/50	3/50	0.33 [0.04, 3.10]
Haynes 1996	2/18	3/23	0.85 [0.16, 4.57]
Hoffman 1996	1/23	1/31	1.35 [0.09, 20.44]
Kuwabara 1998	1/20	1/23	1.15 [0.08, 17.22]
Michos 2001	0/25	1/24	0.32 [0.01, 7.50]
Mott 1993	3/35	1/34	2.91 [0.32, 26.66]
O'Brien 1995	3/53	1/49	2.77 [0.30, 25.78]
Ovesen 2006	7/73	5/73	1.40 [0.47, 4.21]
Papasimos 2005	2/40	2/40	1.00 [0.15, 6.76]
Park 1998	1/30	1/30	1.00 [0.07, 15.26]
Utrilla 2005	1/82	2/81	0.49 [0.05, 5.34]
Subtotal (95% CI)	**711**	**731**	**1.30 [0.77, 2.19]**
Total events: 29 (Gamma nail), 23 (SHS)			
Heterogeneity: Chi^2 = 5.71, df = 12 (P = 0.93); I^2 =0.0%			



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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.98 (P = 0.33)				
3 Mixed experience (score = 0)				
Leung 1992	2/93	3/93		0.67 [0.11, 3.90]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Subtotal (95% CI)	**136**	**153**		**0.51 [0.11, 2.28]**
Total events: 2 (Gamma nail), 5 (SHS)				
Heterogeneity: Chi^2 = 0.25, df = 1 (P = 0.62); I^2 =0.0%				
Test for overall effect: Z = 0.89 (P = 0.38)				
Total (95% CI)	**1334**	**1361**		**1.15 [0.76, 1.72]**
Total events: 46 (Gamma nail), 41 (SHS)				
Heterogeneity: Chi^2 = 8.69, df = 18 (P = 0.97); I^2 =0.0%				
Test for overall effect: Z = 0.66 (P = 0.51)				

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 2.10. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 10 Cut-out: overall denominators used.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 10 Cut-out: overall denominators used

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Adams 2001	8/203	4/197		1.94 [0.59, 6.34]
Ahrengart 1994	3/105	3/104		0.99 [0.20, 4.80]
Benum 1994	5/226	2/234		2.59 [0.51, 13.21]
Bridle 1991	2/49	3/51		0.69 [0.12, 3.98]
Goldhagen 1994	2/36	0/39		5.41 [0.27, 108.93]
Guyer 1991	1/50	3/50		0.33 [0.04, 3.10]
Haynes 1996	2/19	3/31		1.09 [0.20, 5.93]
Hoffman 1996	1/31	1/36		1.16 [0.08, 17.80]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

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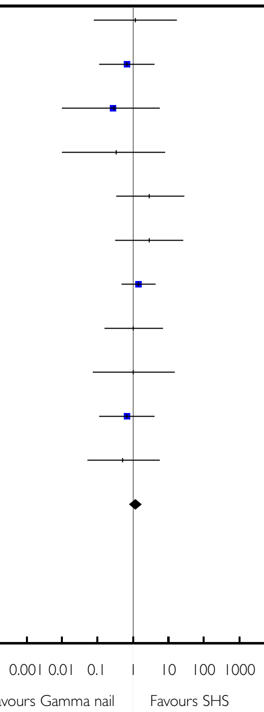
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Kuwabara 1998	1/20	1/23		1.15 [0.08, 17.22]
Leung 1992	2/113	3/113		0.67 [0.11, 3.91]
Marques Lopez 2002	0/43	2/60		0.28 [0.01, 5.63]
Michos 2001	0/26	1/26		0.33 [0.01, 7.82]
Mott 1993	3/35	1/34		2.91 [0.32, 26.66]
O'Brien 1995	3/53	1/49		2.77 [0.30, 25.78]
Ovesen 2006	7/73	5/73		1.40 [0.47, 4.21]
Papasimos 2005	2/40	2/40		1.00 [0.15, 6.76]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Radford 1993	2/100	3/100		0.67 [0.11, 3.90]
Utrilla 2005	1/104	2/106		0.51 [0.05, 5.53]
Total (95% CI)	**1416**	**1456**		**1.17 [0.78, 1.76]**

Total events: 46 (Gamma nail), 41 (SHS)

Heterogeneity: Chi^2 = 8.32, df = 18 (P = 0.97); I^2 =0.0%

Test for overall effect: Z = 0.74 (P = 0.46)



Analysis 2.11. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 11 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

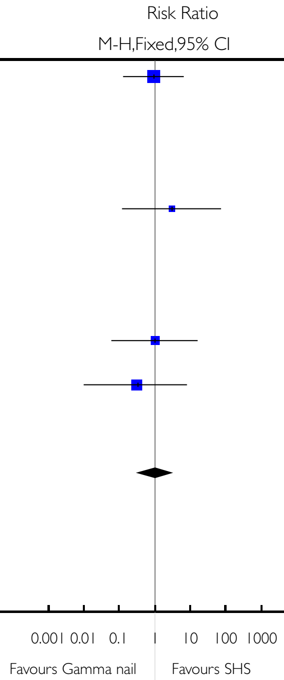
Outcome: 11 Non-union

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
Ahrengart 1994	2/87	2/81	0.93 [0.13, 6.46]
Goldhagen 1994	0/34	0/38	0.0 [0.0, 0.0]
Kukla 1997	0/45	0/44	0.0 [0.0, 0.0]
Leung 1992	1/93	0/93	3.00 [0.12, 72.71]
Michos 2001	0/25	0/24	0.0 [0.0, 0.0]
Ovesen 2006	0/73	0/73	0.0 [0.0, 0.0]
Papasimos 2005	1/40	1/40	1.00 [0.06, 15.44]
Park 1998	0/30	1/30	0.33 [0.01, 7.87]
Radford 1993	0/100	0/100	0.0 [0.0, 0.0]
Total (95% CI)	**527**	**523**	**0.97 [0.29, 3.31]**

Total events: 4 (Gamma nail), 4 (SHS)

Heterogeneity: Chi^2 = 0.92, df = 3 (P = 0.82); I^2 =0.0%

Test for overall effect: Z = 0.05 (P = 0.96)



Analysis 2.12. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 12 Non-union: overall denominators used.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

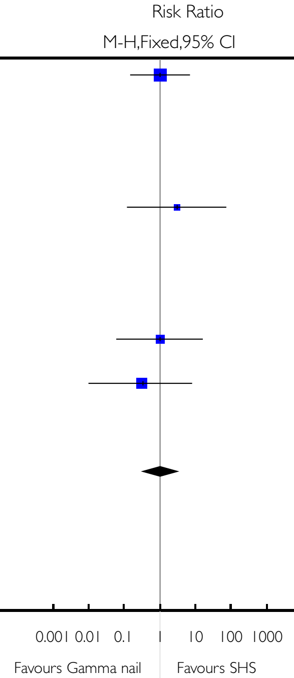
Outcome: 12 Non-union: overall denominators used

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
Ahrengart 1994	2/105	2/104	0.99 [0.14, 6.90]
Goldhagen 1994	0/36	0/39	0.0 [0.0, 0.0]
Kukla 1997	0/60	0/60	0.0 [0.0, 0.0]
Leung 1992	1/113	0/113	3.00 [0.12, 72.87]
Michos 2001	0/26	0/26	0.0 [0.0, 0.0]
Ovesen 2006	0/73	0/73	0.0 [0.0, 0.0]
Papasimos 2005	1/40	1/40	1.00 [0.06, 15.44]
Park 1998	0/30	1/30	0.33 [0.01, 7.87]
Radford 1993	0/100	0/100	0.0 [0.0, 0.0]
Total (95% CI)	**583**	**585**	**1.00 [0.29, 3.40]**

Total events: 4 (Gamma nail), 4 (SHS)

Heterogeneity: Chi^2 = 0.92, df = 3 (P = 0.82); I^2 =0.0%

Test for overall effect: Z = 0.01 (P = 1.0)



Analysis 2.13. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 13 All technical complications of fixation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

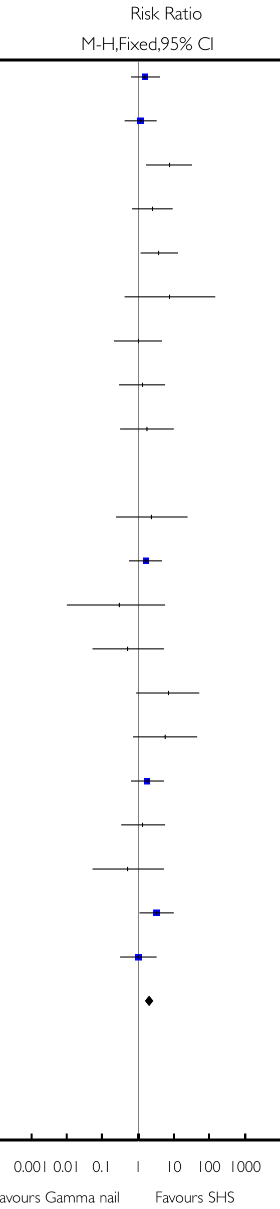
Outcome: 13 All technical complications of fixation

Study or subgroup	Gamma nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI
Adams 2001	11/203	7/197	1.52 [0.60, 3.85]
Ahrengart 1994	7/105	6/104	1.16 [0.40, 3.32]
Benum 1994	14/226	2/234	7.25 [1.67, 31.53]
Bridle 1991	7/49	3/51	2.43 [0.67, 8.86]
Butt 1995	11/47	3/48	3.74 [1.11, 12.58]
Goldhagen 1994	3/36	0/39	7.57 [0.40, 141.62]
Guyer 1991	3/50	3/50	1.00 [0.21, 4.72]
Haynes 1996	3/18	3/23	1.28 [0.29, 5.59]
Hoffman 1996	3/31	2/36	1.74 [0.31, 9.76]
Kukla 1997	0/60	0/60	0.0 [0.0, 0.0]
Kuwabara 1998	2/20	1/23	2.30 [0.23, 23.51]
Leung 1992	8/93	5/93	1.60 [0.54, 4.71]
Marques Lopez 2002	0/43	2/60	0.28 [0.01, 5.63]
Michos 2001	1/26	2/26	0.50 [0.05, 5.18]
Mott 1993	7/35	1/34	6.80 [0.88, 52.37]
O'Brien 1995	6/53	1/49	5.55 [0.69, 44.45]
Ovesen 2006	9/73	5/73	1.80 [0.63, 5.11]
Papasimos 2005	4/40	3/40	1.33 [0.32, 5.58]
Park 1998	1/30	2/30	0.50 [0.05, 5.22]
Radford 1993	13/100	4/100	3.25 [1.10, 9.63]
Utrilla 2005	5/82	5/81	0.99 [0.30, 3.28]
Total (95% CI)	**1420**	**1451**	**2.00 [1.48, 2.69]**

Total events: 118 (Gamma nail), 60 (Sliding hip screw)

Heterogeneity: Chi^2 = 16.62, df = 19 (P = 0.62); I^2 =0.0%

Test for overall effect: Z = 4.52 (P < 0.00001)



Analysis 2.14. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 14 Reoperation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

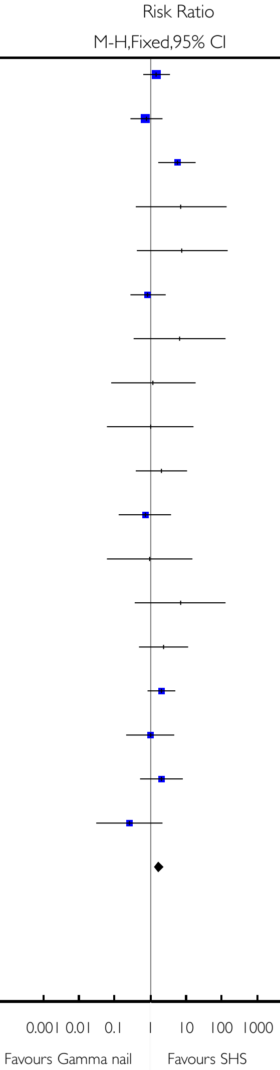
Outcome: 14 Reoperation

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Fixed,95% CI
Adams 2001	12/203	8/197	15.2 %	1.46 [0.61, 3.48]
Ahrengart 1994	6/105	8/104	15.0 %	0.74 [0.27, 2.07]
Benum 1994	16/226	3/234	5.5 %	5.52 [1.63, 18.69]
Butt 1995	3/47	0/48	0.9 %	7.15 [0.38, 134.67]
Goldhagen 1994	3/36	0/39	0.9 %	7.57 [0.40, 141.62]
Guyer 1991	5/50	6/50	11.2 %	0.83 [0.27, 2.55]
Haynes 1996	2/18	0/23	0.8 %	6.32 [0.32, 123.86]
Hoffman 1996	1/31	1/36	1.7 %	1.16 [0.08, 17.80]
Kukla 1997	1/60	1/60	1.9 %	1.00 [0.06, 15.62]
Leung 1992	4/93	2/93	3.7 %	2.00 [0.38, 10.65]
Marques Lopez 2002	2/43	4/60	6.3 %	0.70 [0.13, 3.64]
Michos 2001	1/25	1/24	1.9 %	0.96 [0.06, 14.50]
Mott 1993	3/35	0/34	0.9 %	6.81 [0.36, 127.00]
O'Brien 1995	5/53	2/49	3.9 %	2.31 [0.47, 11.37]
Ovesen 2006	12/73	6/73	11.2 %	2.00 [0.79, 5.04]
Papasimos 2005	3/40	3/40	5.6 %	1.00 [0.21, 4.66]
Radford 1993	6/100	3/100	5.6 %	2.00 [0.51, 7.78]
Utrilla 2005	1/82	4/81	7.5 %	0.25 [0.03, 2.16]
Total (95% CI)	**1320**	**1345**	**100.0 %**	**1.66 [1.19, 2.31]**

Total events: 86 (Gamma nail), 52 (SHS)

Heterogeneity: $Chi^2 = 16.52$, df = 17 (P = 0.49); I^2 =0.0%

Test for overall effect: Z = 3.01 (P = 0.0026)



Analysis 2.15. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 15 Reoperation: overall denominators used.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

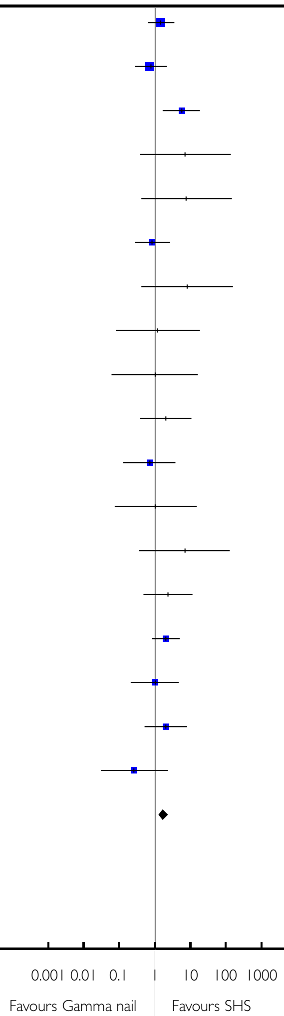
Outcome: 15 Reoperation: overall denominators used

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Adams 2001	12/203	8/197		15.2 %	1.46 [0.61, 3.48]
Ahrengart 1994	6/105	8/104		15.1 %	0.74 [0.27, 2.07]
Benum 1994	16/226	3/234		5.5 %	5.52 [1.63, 18.69]
Butt 1995	3/47	0/48		0.9 %	7.15 [0.38, 134.67]
Goldhagen 1994	3/36	0/39		0.9 %	7.57 [0.40, 141.62]
Guyer 1991	5/50	6/50		11.3 %	0.83 [0.27, 2.55]
Haynes 1996	2/19	0/31		0.7 %	8.00 [0.40, 158.22]
Hoffman 1996	1/31	1/36		1.7 %	1.16 [0.08, 17.80]
Kukla 1997	1/60	1/60		1.9 %	1.00 [0.06, 15.62]
Leung 1992	4/113	2/113		3.8 %	2.00 [0.37, 10.70]
Marques Lopez 2002	2/43	4/60		6.3 %	0.70 [0.13, 3.64]
Michos 2001	1/26	1/26		1.9 %	1.00 [0.07, 15.15]
Mott 1993	3/35	0/34		1.0 %	6.81 [0.36, 127.00]
O'Brien 1995	5/53	2/49		3.9 %	2.31 [0.47, 11.37]
Ovesen 2006	12/73	6/73		11.3 %	2.00 [0.79, 5.04]
Papasimos 2005	3/40	3/40		5.6 %	1.00 [0.21, 4.66]
Radford 1993	6/100	3/100		5.6 %	2.00 [0.51, 7.78]
Utrilla 2005	1/104	4/106		7.4 %	0.25 [0.03, 2.24]
Total (95% CI)	**1364**	**1400**		**100.0 %**	**1.67 [1.20, 2.32]**

Total events: 86 (Gamma nail), 52 (SHS)

Heterogeneity: Chi^2 = 16.71, df = 17 (P = 0.47); I^2 =0.0%

Test for overall effect: Z = 3.05 (P = 0.0023)



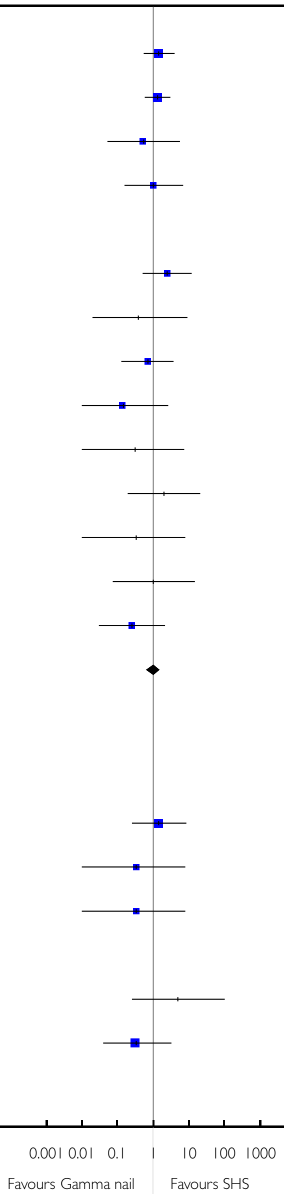
Analysis 2.16. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 16 Wound infection or haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 16 Wound infection or haematoma

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Wound infection - any type				
Adams 2001	9/203	6/197		1.46 [0.53, 4.01]
Ahrengart 1994	12/105	9/104		1.32 [0.58, 3.00]
Bridle 1991	1/49	2/51		0.52 [0.05, 5.56]
Butt 1995	2/47	2/48		1.02 [0.15, 6.95]
Hoffman 1996	0/31	0/36		0.0 [0.0, 0.0]
Kukla 1997	5/60	2/60		2.50 [0.50, 12.39]
Kuwabara 1998	0/20	1/23		0.38 [0.02, 8.86]
Marques Lopez 2002	2/43	4/60		0.70 [0.13, 3.64]
Mott 1993	0/35	3/34		0.14 [0.01, 2.59]
O'Brien 1995	0/53	1/49		0.31 [0.01, 7.40]
Ovesen 2006	2/73	1/73		2.00 [0.19, 21.58]
Papasimos 2005	0/40	1/40		0.33 [0.01, 7.95]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Radford 1993	1/100	4/100		0.25 [0.03, 2.20]
Subtotal (95% CI)	**889**	**905**		**0.97 [0.62, 1.50]**
Total events: 35 (Gamma nail), 37 (SHS)				
Heterogeneity: Chi^2 = 7.75, df = 12 (P = 0.80); I^2 =0.0%				
Test for overall effect: Z = 0.15 (P = 0.88)				
2 Deep wound infection				
Adams 2001	3/203	2/197		1.46 [0.25, 8.62]
Ahrengart 1994	0/105	1/104		0.33 [0.01, 8.01]
Guyer 1991	0/50	1/50		0.33 [0.01, 7.99]
Hoffman 1996	0/31	0/36		0.0 [0.0, 0.0]
Kukla 1997	2/60	0/60		5.00 [0.25, 102.00]
Leung 1992	1/93	3/93		0.33 [0.04, 3.15]
Mott 1993	0/35	0/34		0.0 [0.0, 0.0]



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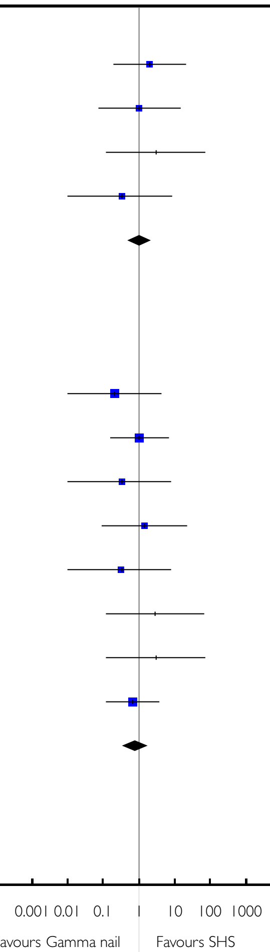
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
O'Brien 1995	0/53	0/49		0.0 [0.0, 0.0]
Ovesen 2006	2/73	1/73		2.00 [0.19, 21.58]
Park 1998	1/30	1/30		1.00 [0.07, 15.26]
Radford 1993	1/100	0/100		3.00 [0.12, 72.77]
Utrilla 2005	0/104	1/106		0.34 [0.01, 8.24]
Subtotal (95% CI)	**937**	**932**		**0.99 [0.46, 2.17]**
Total events: 10 (Gamma nail), 10 (SHS)				
Heterogeneity: Chi² = 4.33, df = 8 (P = 0.83); I² =0.0%				
Test for overall effect: Z = 0.01 (P = 0.99)				
3 Wound haematoma				
Bridle 1991	0/49	2/51		0.21 [0.01, 4.23]
Guyer 1991	2/50	2/50		1.00 [0.15, 6.82]
Kukla 1997	0/60	1/60		0.33 [0.01, 8.02]
Marques Lopez 2002	1/43	1/60		1.40 [0.09, 21.70]
Mott 1993	0/35	1/34		0.32 [0.01, 7.69]
O'Brien 1995	1/52	0/49		2.83 [0.12, 67.87]
Ovesen 2006	1/73	0/73		3.00 [0.12, 72.45]
Papasimos 2005	2/40	3/40		0.67 [0.12, 3.78]
Subtotal (95% CI)	**402**	**417**		**0.78 [0.34, 1.79]**
Total events: 7 (Gamma nail), 10 (SHS)				
Heterogeneity: Chi² = 2.90, df = 7 (P = 0.89); I² =0.0%				
Test for overall effect: Z = 0.58 (P = 0.56)				



Analysis 2.17. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 17 Pneumonia.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

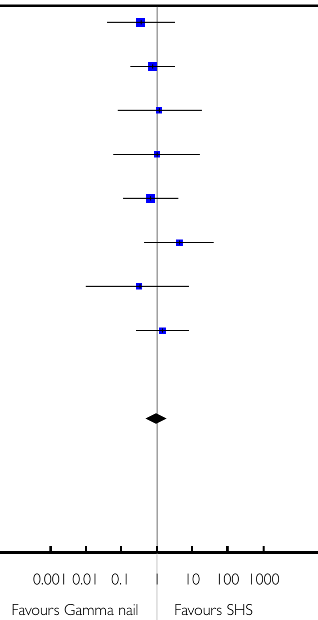
Outcome: 17 Pneumonia

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
Bridle 1991	1/49	3/51	0.35 [0.04, 3.22]
Butt 1995	3/47	4/48	0.77 [0.18, 3.24]
Hoffman 1996	1/31	1/36	1.16 [0.08, 17.80]
Kukla 1997	1/60	1/60	1.00 [0.06, 15.62]
Leung 1992	2/93	3/93	0.67 [0.11, 3.90]
Marques Lopez 2002	3/43	1/60	4.19 [0.45, 38.89]
Mott 1993	0/35	1/34	0.32 [0.01, 7.69]
O'Brien 1995	3/52	2/49	1.41 [0.25, 8.10]
Papasimos 2005	0/40	0/40	0.0 [0.0, 0.0]
Total (95% CI)	**450**	**471**	**0.93 [0.47, 1.83]**

Total events: 14 (Gamma nail), 16 (SHS)

Heterogeneity: $Chi^2 = 3.38$, df = 7 (P = 0.85); $I^2 = 0.0\%$

Test for overall effect: Z = 0.22 (P = 0.82)



Analysis 2.18. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 18 Pressure sore.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

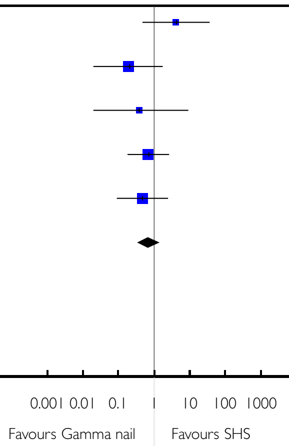
Outcome: 18 Pressure sore

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Bridle 1991	4/49	1/51		6.0 %	4.16 [0.48, 35.95]
Butt 1995	1/47	5/48		30.1 %	0.20 [0.02, 1.68]
Hoffman 1996	0/31	1/36		8.5 %	0.39 [0.02, 9.13]
Marques Lopez 2002	3/43	6/60		30.5 %	0.70 [0.18, 2.64]
O'Brien 1995	2/52	4/49		25.0 %	0.47 [0.09, 2.46]
Total (95% CI)	**222**	**244**		**100.0 %**	**0.67 [0.32, 1.42]**

Total events: 10 (Gamma nail), 17 (SHS)

Heterogeneity: Chi^2 = 4.27, df = 4 (P = 0.37); I^2 =6%

Test for overall effect: Z = 1.04 (P = 0.30)



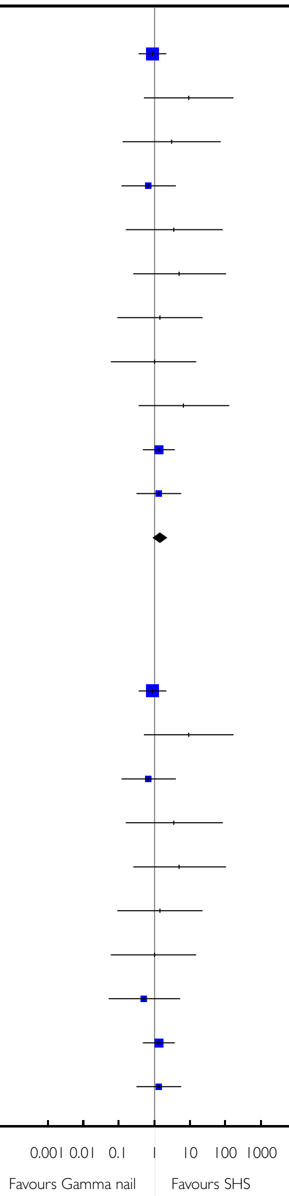
Analysis 2.19. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 19 Thromboembolic complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 19 Thromboembolic complications

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Thromboembolic complication			
Adams 2001	9/203	10/197	0.87 [0.36, 2.10]
Ahrengart 1994	4/105	0/104	8.92 [0.49, 163.53]
Bridle 1991	1/49	0/51	3.12 [0.13, 74.80]
Butt 1995	2/47	3/48	0.68 [0.12, 3.89]
Hoffman 1996	1/31	0/36	3.47 [0.15, 82.21]
Kukla 1997	2/60	0/60	5.00 [0.25, 102.00]
Marques Lopez 2002	1/43	1/60	1.40 [0.09, 21.70]
Mott 1993	1/35	1/34	0.97 [0.06, 14.91]
O'Brien 1995	3/52	0/49	6.60 [0.35, 124.65]
Radford 1993	8/100	6/100	1.33 [0.48, 3.70]
Utrilla 2005	4/82	3/81	1.32 [0.30, 5.70]
Subtotal (95% CI)	**807**	**820**	**1.46 [0.90, 2.36]**
Total events: 36 (Gamma nail), 24 (SHS)			
Heterogeneity: Chi^2 = 5.82, df = 10 (P = 0.83); I^2 =0.0%			
Test for overall effect: Z = 1.52 (P = 0.13)			
2 Deep vein thrombosis			
Adams 2001	9/203	10/197	0.87 [0.36, 2.10]
Ahrengart 1994	4/105	0/104	8.92 [0.49, 163.53]
Butt 1995	2/47	3/48	0.68 [0.12, 3.89]
Hoffman 1996	1/31	0/36	3.47 [0.15, 82.21]
Kukla 1997	2/60	0/60	5.00 [0.25, 102.00]
Marques Lopez 2002	1/43	1/60	1.40 [0.09, 21.70]
Mott 1993	1/35	1/34	0.97 [0.06, 14.91]
Papasimos 2005	1/40	2/40	0.50 [0.05, 5.30]
Radford 1993	8/100	6/100	1.33 [0.48, 3.70]
Utrilla 2005	4/82	3/81	1.32 [0.30, 5.70]



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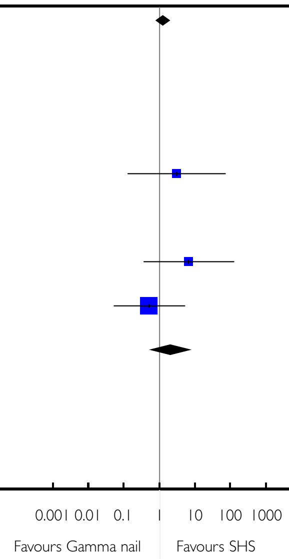
Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Subtotal (95% CI)	**746**	**760**		**1.26 [0.77, 2.06]**
Total events: 33 (Gamma nail), 26 (SHS)				
Heterogeneity: Chi² = 4.73, df = 9 (P = 0.86); I² =0.0%				
Test for overall effect: Z = 0.93 (P = 0.35)				
3 Pulmonary embolism				
Bridle 1991	1/49	0/51		3.12 [0.13, 74.80]
Kukla 1997	0/60	0/60		0.0 [0.0, 0.0]
O'Brien 1995	3/52	0/49		6.60 [0.35, 124.65]
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Subtotal (95% CI)	**201**	**200**		**1.97 [0.50, 7.82]**
Total events: 5 (Gamma nail), 2 (SHS)				
Heterogeneity: Chi² = 2.03, df = 2 (P = 0.36); I² =1%				
Test for overall effect: Z = 0.97 (P = 0.33)				



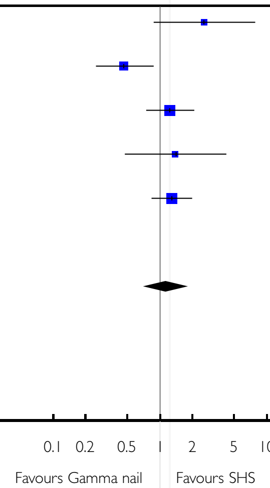
Analysis 2.20. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 20 Any medical complication.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 20 Any medical complication

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Random,95% CI	Risk Ratio M-H,Random,95% CI
Bridle 1991	10/49	4/51		2.60 [0.87, 7.75]
Butt 1995	10/47	22/48		0.46 [0.25, 0.87]
Hoffman 1996	16/31	15/36		1.24 [0.74, 2.07]
Kukla 1997	7/60	5/60		1.40 [0.47, 4.17]
O'Brien 1995	26/52	19/49		1.29 [0.83, 2.01]
Ovesen 2006	0/73	0/73		0.0 [0.0, 0.0]
Total (95% CI)	**312**	**317**		**1.13 [0.69, 1.84]**
Total events: 69 (Gamma nail), 65 (SHS)				
Heterogeneity: Tau² = 0.18; Chi² = 10.48, df = 4 (P = 0.03); I² =62%				
Test for overall effect: Z = 0.47 (P = 0.64)				



Analysis 2.21. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 21 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

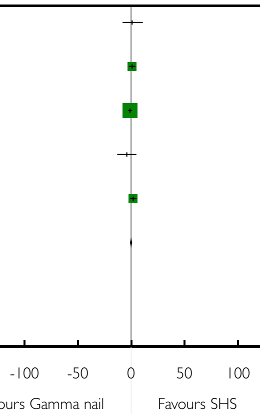
Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 21 Length of hospital stay (days)

Study or subgroup	Gamma nail N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Hoffman 1996	31	29.8 (20.1)	36	28.5 (18.9)		2.1 %	1.30 [-8.09, 10.69]
Kukla 1997	60	15.1 (8.5)	60	14.1 (8.3)		20.9 %	1.00 [-2.01, 4.01]
Leung 1992	93	26.9 (8.2)	93	28.3 (4.5)		52.2 %	-1.40 [-3.30, 0.50]
O'Brien 1995	52	23.7 (19)	49	27.6 (26.8)		2.3 %	-3.90 [-13.01, 5.21]
Ovesen 2006	73	16.4 (8.4)	73	14.4 (9.4)		22.5 %	2.00 [-0.89, 4.89]
Total (95% CI)	**309**		**311**			**100.0 %**	**-0.13 [-1.50, 1.24]**

Heterogeneity: $Chi^2 = 5.09$, df = 4 (P = 0.28); $I^2 = 21\%$

Test for overall effect: Z = 0.19 (P = 0.85)



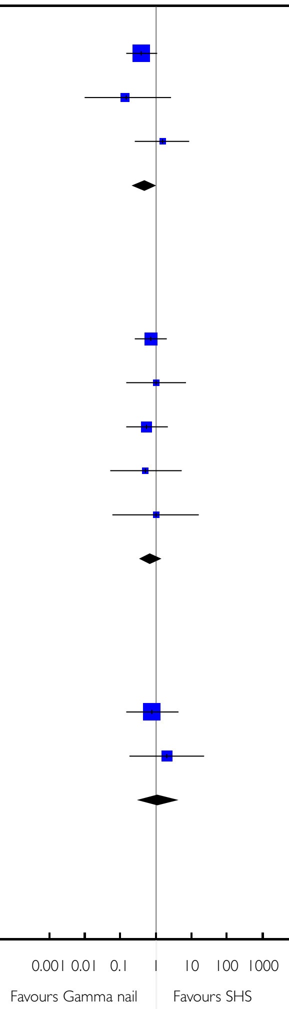
Analysis 2.22. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 22 Anatomical deformity.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 22 Anatomical deformity

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Shortening of leg					
Guyer 1991	4/28	12/32		66.9 %	0.38 [0.14, 1.05]
Kukla 1997	0/45	3/44		21.1 %	0.14 [0.01, 2.63]
Leung 1992	3/93	2/93		11.9 %	1.50 [0.26, 8.77]
Subtotal (95% CI)	**166**	**169**		**100.0 %**	**0.46 [0.21, 1.03]**
Total events: 7 (Gamma nail), 17 (SHS)					
Heterogeneity: Chi^2 = 2.48, df = 2 (P = 0.29); I^2 =19%					
Test for overall effect: Z = 1.89 (P = 0.059)					
2 Varus deformity					
Ahrengart 1994	6/87	8/81		44.8 %	0.70 [0.25, 1.93]
Leung 1992	2/93	2/93		10.8 %	1.00 [0.14, 6.95]
O'Brien 1995	3/53	5/49		28.1 %	0.55 [0.14, 2.20]
Park 1998	1/30	2/30		10.8 %	0.50 [0.05, 5.22]
Utrilla 2005	1/82	1/81		5.4 %	0.99 [0.06, 15.53]
Subtotal (95% CI)	**345**	**334**		**100.0 %**	**0.68 [0.34, 1.37]**
Total events: 13 (Gamma nail), 18 (SHS)					
Heterogeneity: Chi^2 = 0.37, df = 4 (P = 0.98); I^2 =0.0%					
Test for overall effect: Z = 1.08 (P = 0.28)					
3 External rotational deformity					
Kuwabara 1998	2/20	3/23		73.6 %	0.77 [0.14, 4.14]
Leung 1992	2/93	1/93		26.4 %	2.00 [0.18, 21.68]
Subtotal (95% CI)	**113**	**116**		**100.0 %**	**1.09 [0.28, 4.19]**
Total events: 4 (Gamma nail), 4 (SHS)					
Heterogeneity: Chi^2 = 0.42, df = 1 (P = 0.52); I^2 =0.0%					
Test for overall effect: Z = 0.13 (P = 0.90)					



Analysis 2.23. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 23 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

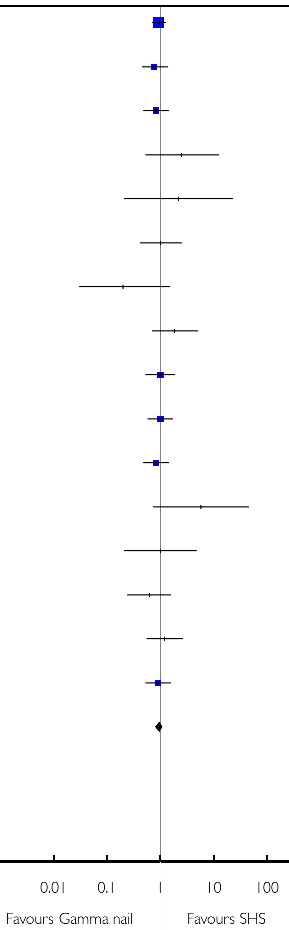
Outcome: 23 Mortality

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Adams 2001	59/203	61/197		27.9 %	0.94 [0.70, 1.27]
Ahrengart 1994	18/105	23/104		10.4 %	0.78 [0.45, 1.35]
Bridle 1991	15/49	19/51		8.4 %	0.82 [0.47, 1.43]
Butt 1995	5/47	2/48		0.9 %	2.55 [0.52, 12.52]
Goldhagen 1994	2/36	1/39		0.4 %	2.17 [0.21, 22.89]
Guyer 1991	8/50	8/50		3.6 %	1.00 [0.41, 2.46]
Haynes 1996	1/19	8/31		2.7 %	0.20 [0.03, 1.51]
Hoffman 1996	8/31	5/36		2.1 %	1.86 [0.68, 5.10]
Kukla 1997	14/60	14/60		6.3 %	1.00 [0.52, 1.91]
Leung 1992	20/113	20/113		9.0 %	1.00 [0.57, 1.75]
Marques Lopez 2002	13/43	22/60		8.3 %	0.82 [0.47, 1.45]
O'Brien 1995	6/52	1/49		0.5 %	5.65 [0.71, 45.29]
Ovesen 2006	3/73	3/73		1.3 %	1.00 [0.21, 4.79]
Pahlpatz 1993	6/51	10/53		4.4 %	0.62 [0.24, 1.59]
Radford 1993	12/100	10/100		4.5 %	1.20 [0.54, 2.65]
Utrilla 2005	19/104	21/106		9.4 %	0.92 [0.53, 1.61]
Total (95% CI)	**1136**	**1170**		**100.0 %**	**0.95 [0.81, 1.12]**

Total events: 209 (Gamma nail), 228 (SHS)

Heterogeneity: Chi^2 = 10.99, df = 15 (P = 0.75); I^2 =0.0%

Test for overall effect: Z = 0.59 (P = 0.56)



Analysis 2.24. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 24 Mortality (allocation concealment: Cochrane rating A,B,C).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 24 Mortality (allocation concealment: Cochrane rating A,B,C)

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Allocation concealment: A (fully concealed)					
Hoffman 1996	8/31	5/36		2.1 %	1.86 [0.68, 5.10]
O'Brien 1995	6/52	1/49		0.5 %	5.65 [0.71, 45.29]
Ovesen 2006	3/73	3/73		1.3 %	1.00 [0.21, 4.79]
Subtotal (95% CI)	**156**	**158**		**3.9 %**	**2.01 [0.94, 4.33]**
Total events: 17 (Gamma nail), 9 (SHS)					
Heterogeneity: Chi^2 = 1.74, df = 2 (P = 0.42); I^2 =0.0%					
Test for overall effect: Z = 1.79 (P = 0.074)					
2 Allocation concealment: B (unknown)					
Adams 2001	59/203	61/197		27.9 %	0.94 [0.70, 1.27]
Ahrengart 1994	18/105	23/104		10.4 %	0.78 [0.45, 1.35]
Bridle 1991	15/49	19/51		8.4 %	0.82 [0.47, 1.43]
Kukla 1997	14/60	14/60		6.3 %	1.00 [0.52, 1.91]
Pahlpatz 1993	6/51	10/53		4.4 %	0.62 [0.24, 1.59]
Radford 1993	12/100	10/100		4.5 %	1.20 [0.54, 2.65]
Utrilla 2005	19/104	21/106		9.4 %	0.92 [0.53, 1.61]
Subtotal (95% CI)	**672**	**671**		**71.2 %**	**0.90 [0.74, 1.10]**
Total events: 143 (Gamma nail), 158 (SHS)					
Heterogeneity: Chi^2 = 1.66, df = 6 (P = 0.95); I^2 =0.0%					
Test for overall effect: Z = 1.04 (P = 0.30)					
3 Allocation concealment: C (not concealed)					
Butt 1995	5/47	2/48		0.9 %	2.55 [0.52, 12.52]
Goldhagen 1994	2/36	1/39		0.4 %	2.17 [0.21, 22.89]
Guyer 1991	8/50	8/50		3.6 %	1.00 [0.41, 2.46]
Haynes 1996	1/19	8/31		2.7 %	0.20 [0.03, 1.51]
Leung 1992	20/113	20/113		9.0 %	1.00 [0.57, 1.75]
Marques Lopez 2002	13/43	22/60		8.3 %	0.82 [0.47, 1.45]
Subtotal (95% CI)	**308**	**341**		**24.9 %**	**0.93 [0.66, 1.31]**

0.01 0.1 1 10 100

Favours Gamma nail Favours SHS

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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 49 (Gamma nail), 61 (SHS)					
Heterogeneity: Chi² = 4.52, df = 5 (P = 0.48); I² =0.0%					
Test for overall effect: Z = 0.42 (P = 0.68)					
Total (95% CI)	**1136**	**1170**		**100.0 %**	**0.95 [0.81, 1.12]**
Total events: 209 (Gamma nail), 228 (SHS)					
Heterogeneity: Chi² = 10.99, df = 15 (P = 0.75); I² =0.0%					
Test for overall effect: Z = 0.59 (P = 0.56)					

0.01 0.1 1 10 100

Favours Gamma nail Favours SHS

Analysis 2.25. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 25 Pain at follow up.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 25 Pain at follow up

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Ahrengart 1994	25/88	15/83		13.2 %	1.57 [0.89, 2.77]
Guyer 1991	19/28	18/32		14.3 %	1.21 [0.81, 1.80]
Hoffman 1996	9/23	9/31		6.5 %	1.35 [0.64, 2.85]
Leung 1992	22/93	32/93		27.3 %	0.69 [0.43, 1.09]
Utrilla 2005	50/82	45/81		38.6 %	1.10 [0.85, 1.42]
Total (95% CI)	**314**	**320**		**100.0 %**	**1.08 [0.90, 1.30]**
Total events: 125 (Gamma nail), 119 (SHS)					
Heterogeneity: Chi² = 6.03, df = 4 (P = 0.20); I² =34%					
Test for overall effect: Z = 0.81 (P = 0.42)					

0.1 0.2 0.5 1 2 5 10

Favours Gamma nail Favours SHS

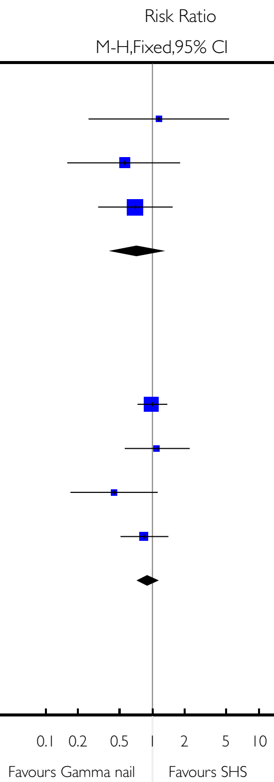
Analysis 2.26. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 26 Non-return to previous residence.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 26 Non-return to previous residence

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Non-return to previous residence (survivors)				
Guyer 1991	3/28	3/32	13.9 %	1.14 [0.25, 5.21]
Haynes 1996	3/18	7/23	30.4 %	0.55 [0.16, 1.82]
Pahlpatz 1993	8/45	11/43	55.7 %	0.69 [0.31, 1.56]
Subtotal (95% CI)	**91**	**98**	**100.0 %**	**0.71 [0.39, 1.31]**
Total events: 14 (Gamma nail), 21 (SHS)				
Heterogeneity: Chi^2 = 0.56, df = 2 (P = 0.76); I^2 =0.0%				
Test for overall effect: Z = 1.09 (P = 0.28)				
2 Non-return to previous residence or dead				
Ahrengart 1994	43/105	43/104	50.5 %	0.99 [0.72, 1.37]
Guyer 1991	11/36	11/40	12.2 %	1.11 [0.55, 2.25]
Haynes 1996	4/19	15/31	13.3 %	0.44 [0.17, 1.12]
Pahlpatz 1993	17/51	21/53	24.1 %	0.84 [0.50, 1.40]
Subtotal (95% CI)	**211**	**228**	**100.0 %**	**0.90 [0.70, 1.15]**
Total events: 75 (Gamma nail), 90 (SHS)				
Heterogeneity: Chi^2 = 3.04, df = 3 (P = 0.39); I^2 =1%				
Test for overall effect: Z = 0.88 (P = 0.38)				



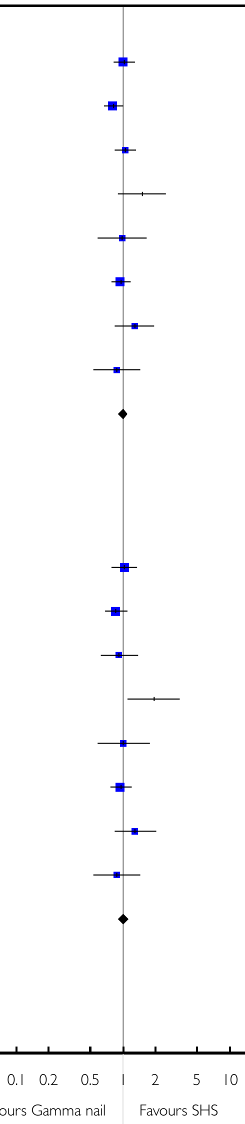
Analysis 2.27. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 27 Impaired walking.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 27 Impaired walking

Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Impaired walking					
Adams 2001	70/126	66/121		23.8 %	1.02 [0.81, 1.28]
Ahrengart 1994	53/87	61/81		22.3 %	0.81 [0.66, 1.00]
Guyer 1991	24/28	26/32		8.6 %	1.05 [0.84, 1.32]
Haynes 1996	13/18	11/23		3.4 %	1.51 [0.90, 2.53]
Kukla 1997	17/45	17/44		6.1 %	0.98 [0.58, 1.66]
Leung 1992	59/93	62/93		21.9 %	0.95 [0.77, 1.17]
Ovesen 2006	30/67	23/66		8.2 %	1.28 [0.84, 1.96]
Park 1998	14/30	16/30		5.7 %	0.88 [0.53, 1.45]
Subtotal (95% CI)	**494**	**490**		**100.0 %**	**0.99 [0.89, 1.10]**
Total events: 280 (Gamma nail), 282 (SHS)					
Heterogeneity: $Chi^2 = 8.33$, df = 7 (P = 0.30); I^2 =16%					
Test for overall effect: Z = 0.22 (P = 0.82)					
2 Impaired walking (overall denominators used)					
Adams 2001	70/203	66/197		23.9 %	1.03 [0.78, 1.35]
Ahrengart 1994	53/105	61/104		21.8 %	0.86 [0.67, 1.10]
Guyer 1991	24/50	26/50		9.3 %	0.92 [0.62, 1.37]
Haynes 1996	13/19	11/31		3.0 %	1.93 [1.10, 3.39]
Kukla 1997	17/60	17/60		6.1 %	1.00 [0.57, 1.77]
Leung 1992	59/113	62/113		22.1 %	0.95 [0.75, 1.21]
Ovesen 2006	30/73	23/73		8.2 %	1.30 [0.84, 2.02]
Park 1998	14/30	16/30		5.7 %	0.88 [0.53, 1.45]
Subtotal (95% CI)	**653**	**658**		**100.0 %**	**1.00 [0.89, 1.13]**
Total events: 280 (Gamma nail), 282 (SHS)					
Heterogeneity: $Chi^2 = 8.67$, df = 7 (P = 0.28); I^2 =19%					
Test for overall effect: Z = 0.07 (P = 0.95)					



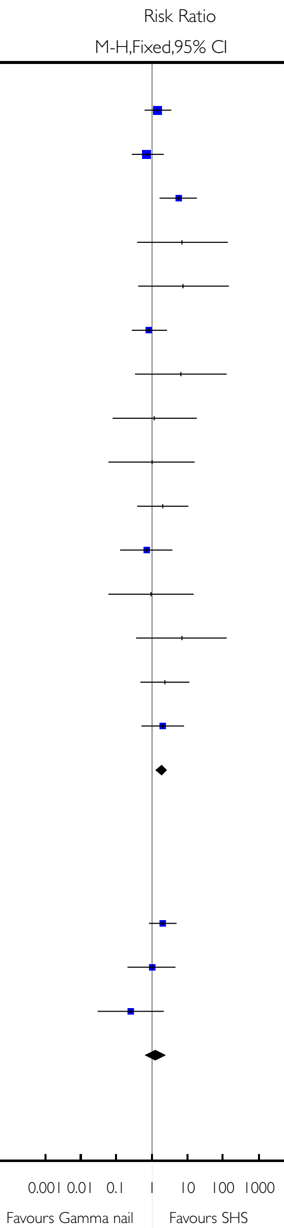
Analysis 2.28. Comparison 2 Gamma nail versus sliding hip screw (SHS), Outcome 28 Reoperation - subgrouped by type of Gamma nail.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 2 Gamma nail versus sliding hip screw (SHS)

Outcome: 28 Reoperation - subgrouped by type of Gamma nail

Study or subgroup	Gamma nail n/N	SHS n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma 1 nail				
Adams 2001	12/203	8/197	15.2 %	1.46 [0.61, 3.48]
Ahrengart 1994	6/105	8/104	15.0 %	0.74 [0.27, 2.07]
Benum 1994	16/226	3/234	5.5 %	5.52 [1.63, 18.69]
Butt 1995	3/47	0/48	0.9 %	7.15 [0.38, 134.67]
Goldhagen 1994	3/36	0/39	0.9 %	7.57 [0.40, 141.62]
Guyer 1991	5/50	6/50	11.2 %	0.83 [0.27, 2.55]
Haynes 1996	2/18	0/23	0.8 %	6.32 [0.32, 123.86]
Hoffman 1996	1/31	1/36	1.7 %	1.16 [0.08, 17.80]
Kukla 1997	1/60	1/60	1.9 %	1.00 [0.06, 15.62]
Leung 1992	4/93	2/93	3.7 %	2.00 [0.38, 10.65]
Marques Lopez 2002	2/43	4/60	6.3 %	0.70 [0.13, 3.64]
Michos 2001	1/25	1/24	1.9 %	0.96 [0.06, 14.50]
Mott 1993	3/35	0/34	0.9 %	6.81 [0.36, 127.00]
O'Brien 1995	5/53	2/49	3.9 %	2.31 [0.47, 11.37]
Radford 1993	6/100	3/100	5.6 %	2.00 [0.51, 7.78]
Subtotal (95% CI)	**1125**	**1151**	**75.6 %**	**1.80 [1.24, 2.62]**
Total events: 70 (Gamma nail), 39 (SHS)				
Heterogeneity: Chi^2 = 13.29, df = 14 (P = 0.50); I^2 =0.0%				
Test for overall effect: Z = 3.07 (P = 0.0021)				
2 Trochanteric Gamma nail				
Ovesen 2006	12/73	6/73	11.2 %	2.00 [0.79, 5.04]
Papasimos 2005	3/40	3/40	5.6 %	1.00 [0.21, 4.66]
Utrilla 2005	1/82	4/81	7.5 %	0.25 [0.03, 2.16]
Subtotal (95% CI)	**195**	**194**	**24.4 %**	**1.23 [0.61, 2.47]**
Total events: 16 (Gamma nail), 13 (SHS)				
Heterogeneity: Chi^2 = 3.24, df = 2 (P = 0.20); I^2 =38%				



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Study or subgroup	Gamma nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.58 (P = 0.56)					
Total (95% CI)	**1320**	**1345**		**100.0 %**	**1.66 [1.19, 2.31]**
Total events: 86 (Gamma nail), 52 (SHS)					
Heterogeneity: Chi^2 = 16.52, df = 17 (P = 0.49); I^2 =0.0%					
Test for overall effect: Z = 3.01 (P = 0.0026)					

0.001 0.01 0.1 1 10 100 1000

Favours Gamma nail Favours SHS

Analysis 3.1. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes) - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes) - random-effects model

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Baumgaertner 1998	67	72 (33)	68	80 (35)		32.8 %	-8.00 [-19.47, 3.47]
Hardy 1998	50	71 (28.9)	50	57 (24.8)		33.6 %	14.00 [3.44, 24.56]
Harrington 2002	50	108 (26.8)	52	88 (27.5)		33.6 %	20.00 [9.46, 30.54]
Total (95% CI)	**167**		**170**			**100.0 %**	**8.81 [-7.43, 25.05]**
Heterogeneity: Tau^2 = 175.30; Chi^2 = 13.45, df = 2 (P = 0.001); I^2 =85%							
Test for overall effect: Z = 1.06 (P = 0.29)							

-100 -50 0 50 100

Favours IMHS Favours SHS

Analysis 3.2. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 2 Blood loss (ml).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

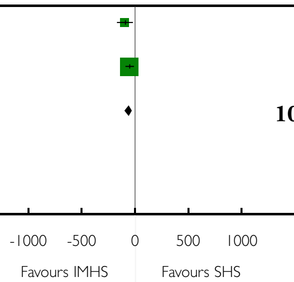
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 2 Blood loss (ml)

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Baumgaertner 1998	67	245 (145)	68	340 (302)		20.5 %	-95.00 [-174.74, -15.26]
Hardy 1998	50	144 (120.5)	50	198 (82.9)		79.5 %	-54.00 [-94.54, -13.46]
Total (95% CI)	**117**		**118**			**100.0 %**	**-62.42 [-98.56, -26.28]**

Heterogeneity: $Chi^2 = 0.81$, df = 1 (P = 0.37); $I^2 = 0.0\%$

Test for overall effect: Z = 3.39 (P = 0.00071)



Analysis 3.3. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 3 Transfusion (units of red cells) - random-effects model.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

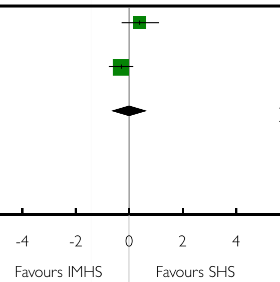
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 3 Transfusion (units of red cells) - random-effects model

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Baumgaertner 1998	67	2.2 (2.4)	68	1.8 (1.7)		42.2 %	0.40 [-0.30, 1.10]
Hardy 1998	50	0.9 (0.96)	50	1.2 (1.29)		57.8 %	-0.30 [-0.75, 0.15]
Total (95% CI)	**117**		**118**			**100.0 %**	**0.00 [-0.68, 0.67]**

Heterogeneity: $Tau^2 = 0.15$; $Chi^2 = 2.72$, df = 1 (P = 0.10); $I^2 = 63\%$

Test for overall effect: Z = 0.01 (P = 0.99)



Analysis 3.4. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 4 Number of patients transfused.

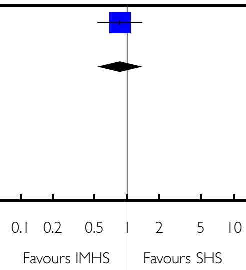
Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 4 Number of patients transfused

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Harrington 2002	18/50	22/52		100.0 %	0.85 [0.52, 1.39]
Total (95% CI)	**50**	**52**		**100.0 %**	**0.85 [0.52, 1.39]**

Total events: 18 (IMHS), 22 (SHS)
Heterogeneity: not applicable
Test for overall effect: Z = 0.65 (P = 0.52)



Analysis 3.5. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 5 Radiographic screening time (minutes).

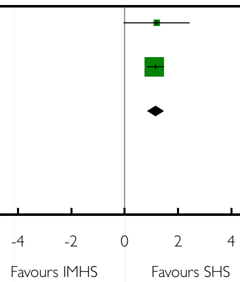
Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 5 Radiographic screening time (minutes)

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Baumgaertner 1998	67	4 (3.2)	68	2.8 (4.1)		6.6 %	1.20 [-0.04, 2.44]
Harrington 2002	50	2.27 (0.89)	52	1.12 (0.81)		93.4 %	1.15 [0.82, 1.48]
Total (95% CI)	**117**		**120**			**100.0 %**	**1.15 [0.83, 1.47]**

Heterogeneity: $Chi^2 = 0.01$, df = 1 (P = 0.94); $I^2 = 0.0\%$
Test for overall effect: Z = 7.08 (P < 0.00001)



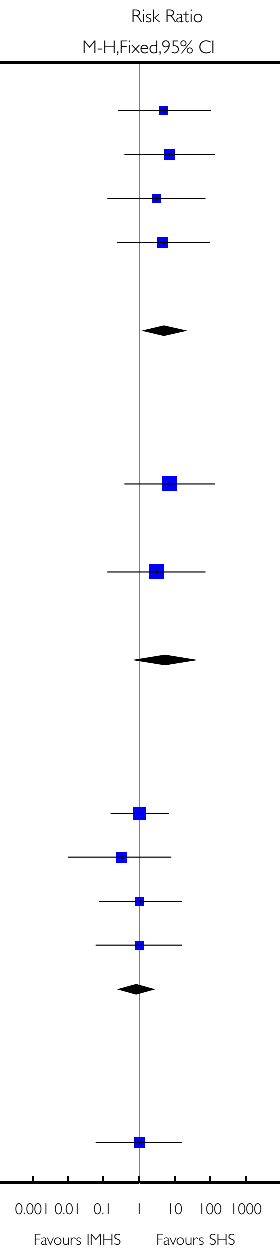
Analysis 3.6. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 6 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 6 Fracture fixation complications

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Operative fracture of femur			
Baumgaertner 1998	2/67	0/68	5.07 [0.25, 103.74]
Hardy 1998	3/50	0/50	7.00 [0.37, 132.10]
Harrington 2002	1/50	0/52	3.12 [0.13, 74.78]
Hoffmann 1999	2/56	0/54	4.82 [0.24, 98.24]
Mehdi 2000	0/90	0/90	0.0 [0.0, 0.0]
Subtotal (95% CI)	**313**	**314**	**5.01 [1.11, 22.65]**
Total events: 8 (IMHS), 0 (SHS)			
Heterogeneity: $Chi^2 = 0.14$, df = 3 (P = 0.99); I^2 =0.0%			
Test for overall effect: Z = 2.09 (P = 0.036)			
2 Later fracture of femur			
Baumgaertner 1998	3/67	0/68	7.10 [0.37, 134.92]
Hardy 1998	0/50	0/50	0.0 [0.0, 0.0]
Harrington 2002	1/50	0/52	3.12 [0.13, 74.78]
Hoffmann 1999	0/56	0/54	0.0 [0.0, 0.0]
Subtotal (95% CI)	**223**	**224**	**5.12 [0.61, 43.33]**
Total events: 4 (IMHS), 0 (SHS)			
Heterogeneity: $Chi^2 = 0.14$, df = 1 (P = 0.71); I^2 =0.0%			
Test for overall effect: Z = 1.50 (P = 0.13)			
3 Cut-out			
Baumgaertner 1998	2/67	2/68	1.01 [0.15, 7.00]
Hardy 1998	0/50	1/50	0.33 [0.01, 7.99]
Harrington 2002	1/50	1/52	1.04 [0.07, 16.18]
Mehdi 2000	1/90	1/90	1.00 [0.06, 15.74]
Subtotal (95% CI)	**257**	**260**	**0.83 [0.24, 2.84]**
Total events: 4 (IMHS), 5 (SHS)			
Heterogeneity: $Chi^2 = 0.40$, df = 3 (P = 0.94); I^2 =0.0%			
Test for overall effect: Z = 0.30 (P = 0.77)			
4 Non-union			
Baumgaertner 1998	1/67	1/68	1.01 [0.06, 15.90]



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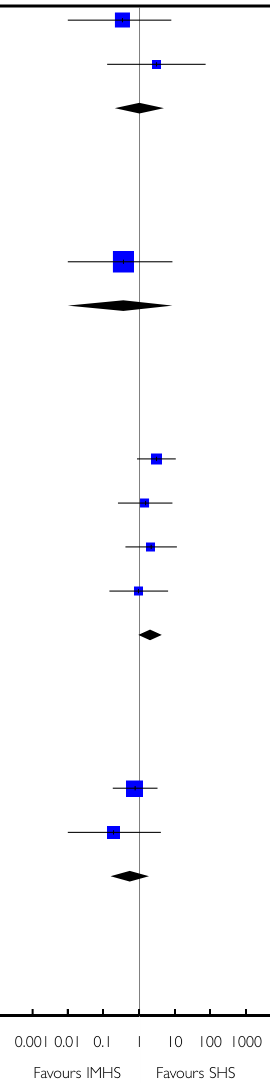
Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Hardy 1998	0/35	1/35		0.33 [0.01, 7.91]
Harrington 2002	1/50	0/52		3.12 [0.13, 74.78]
Subtotal (95% CI)	**152**	**155**		**1.02 [0.21, 4.95]**
Total events: 2 (IMHS), 2 (SHS)				
Heterogeneity: Chi² = 0.95, df = 2 (P = 0.62); I² =0.0%				
Test for overall effect: Z = 0.02 (P = 0.98)				
5 Detachment of the plate from the femur				
Harrington 2002	0/50	1/52		0.35 [0.01, 8.31]
Subtotal (95% CI)	**50**	**52**		**0.35 [0.01, 8.31]**
Total events: 0 (IMHS), 1 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.65 (P = 0.51)				
6 All technical complications of fixation				
Baumgaertner 1998	9/67	3/68		3.04 [0.86, 10.76]
Hardy 1998	3/50	2/50		1.50 [0.26, 8.60]
Harrington 2002	4/50	2/52		2.08 [0.40, 10.86]
Hoffmann 1999	2/56	2/54		0.96 [0.14, 6.60]
Subtotal (95% CI)	**223**	**224**		**2.02 [0.93, 4.39]**
Total events: 18 (IMHS), 9 (SHS)				
Heterogeneity: Chi² = 1.09, df = 3 (P = 0.78); I² =0.0%				
Test for overall effect: Z = 1.77 (P = 0.076)				
7 Reoperation				
Hardy 1998	3/50	4/50		0.75 [0.18, 3.18]
Hoffmann 1999	0/56	2/54		0.19 [0.01, 3.93]
Subtotal (95% CI)	**106**	**104**		**0.53 [0.15, 1.88]**
Total events: 3 (IMHS), 6 (SHS)				
Heterogeneity: Chi² = 0.65, df = 1 (P = 0.42); I² =0.0%				
Test for overall effect: Z = 0.98 (P = 0.33)				



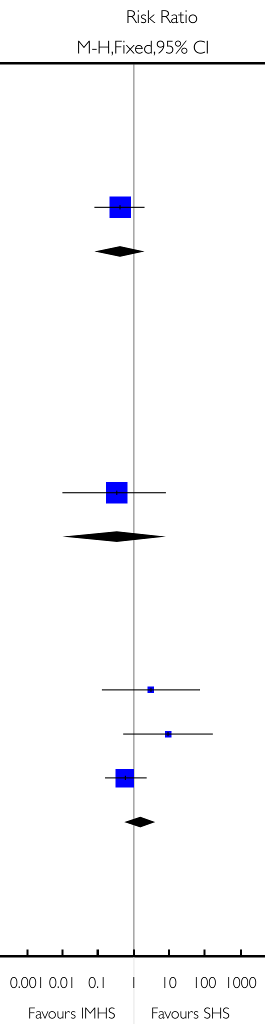
Analysis 3.7. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 7 Wound infection or haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 7 Wound infection or haematoma

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI
1 Wound infection - any type			
Hardy 1998	0/50	0/50	0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54	0.0 [0.0, 0.0]
Mehdi 2000	2/90	5/90	0.40 [0.08, 2.01]
Subtotal (95% CI)	**196**	**194**	**0.40 [0.08, 2.01]**
Total events: 2 (IMHS), 5 (SHS)			
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); I^2 =0.0%			
Test for overall effect: Z = 1.11 (P = 0.27)			
2 Deep wound infection			
Hardy 1998	0/50	0/50	0.0 [0.0, 0.0]
Hoffmann 1999	0/56	0/54	0.0 [0.0, 0.0]
Mehdi 2000	0/90	1/90	0.33 [0.01, 8.08]
Subtotal (95% CI)	**196**	**194**	**0.33 [0.01, 8.08]**
Total events: 0 (IMHS), 1 (SHS)			
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); I^2 =0.0%			
Test for overall effect: Z = 0.68 (P = 0.50)			
3 Wound haematoma			
Baumgaertner 1998	1/67	0/68	3.04 [0.13, 73.42]
Hardy 1998	4/50	0/50	9.00 [0.50, 162.89]
Hoffmann 1999	3/56	5/54	0.58 [0.15, 2.30]
Subtotal (95% CI)	**173**	**172**	**1.47 [0.54, 4.02]**
Total events: 8 (IMHS), 5 (SHS)			
Heterogeneity: $Chi^2 = 3.46$, df = 2 (P = 0.18); I^2 =42%			
Test for overall effect: Z = 0.75 (P = 0.45)			



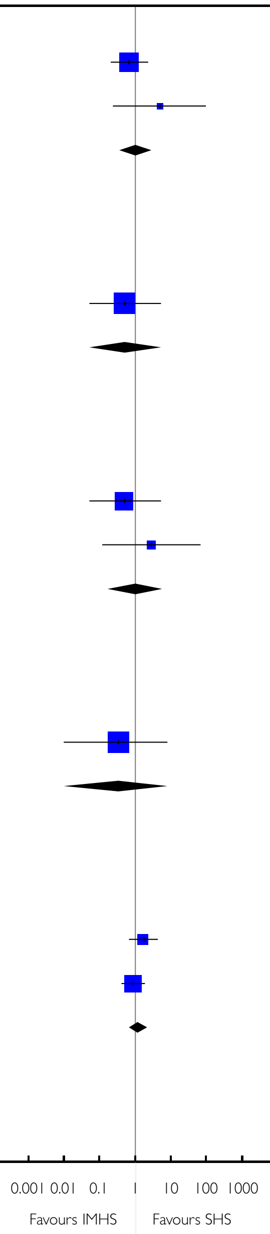
Analysis 3.8. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 8 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 8 Post-operative complications

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Mortality					
Hardy 1998	4/50	6/50		92.2 %	0.67 [0.20, 2.22]
Hoffmann 1999	2/56	0/54		7.8 %	4.82 [0.24, 98.24]
Subtotal (95% CI)	**106**	**104**		**100.0 %**	**0.99 [0.35, 2.83]**
Total events: 6 (IMHS), 6 (SHS)					
Heterogeneity: Chi^2 = 1.48, df = 1 (P = 0.22); I^2 =32%					
Test for overall effect: Z = 0.02 (P = 0.99)					
2 Thromboembolic complication					
Hardy 1998	1/50	2/50		100.0 %	0.50 [0.05, 5.34]
Subtotal (95% CI)	**50**	**50**		**100.0 %**	**0.50 [0.05, 5.34]**
Total events: 1 (IMHS), 2 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.57 (P = 0.57)					
3 Deep vein thrombosis					
Hardy 1998	1/50	2/50		79.7 %	0.50 [0.05, 5.34]
Hoffmann 1999	1/56	0/54		20.3 %	2.89 [0.12, 69.55]
Subtotal (95% CI)	**106**	**104**		**100.0 %**	**0.99 [0.17, 5.62]**
Total events: 2 (IMHS), 2 (SHS)					
Heterogeneity: Chi^2 = 0.76, df = 1 (P = 0.38); I^2 =0.0%					
Test for overall effect: Z = 0.02 (P = 0.99)					
4 Pulmonary embolism					
Hardy 1998	0/50	1/50		100.0 %	0.33 [0.01, 7.99]
Subtotal (95% CI)	**50**	**50**		**100.0 %**	**0.33 [0.01, 7.99]**
Total events: 0 (IMHS), 1 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.68 (P = 0.50)					
5 Major medical complication					
Baumgaertner 1998	10/67	6/68		34.7 %	1.69 [0.65, 4.39]
Hoffmann 1999	10/56	11/54		65.3 %	0.88 [0.41, 1.89]
Subtotal (95% CI)	**123**	**122**		**100.0 %**	**1.16 [0.64, 2.10]**
Total events: 20 (IMHS), 17 (SHS)					
Heterogeneity: Chi^2 = 1.11, df = 1 (P = 0.29); I^2 =10%					
Test for overall effect: Z = 0.49 (P = 0.62)					



Analysis 3.9. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 9 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

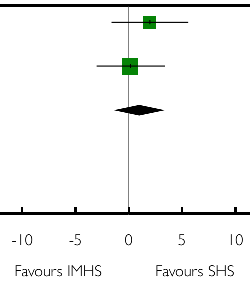
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 9 Length of hospital stay (days)

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Baumgaertner 1998	67	13 (14)	68	11 (5)		44.4 %	2.00 [-1.56, 5.56]
Harrington 2002	50	16.5 (8.8)	52	16.3 (7.5)		55.6 %	0.20 [-2.98, 3.38]
Total (95% CI)	**117**		**120**			**100.0 %**	**1.00 [-1.37, 3.37]**

Heterogeneity: $Chi^2 = 0.55$, df = 1 (P = 0.46); $I^2 = 0.0\%$

Test for overall effect: Z = 0.83 (P = 0.41)



Analysis 3.10. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 10 Mean limb shortening (cm).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

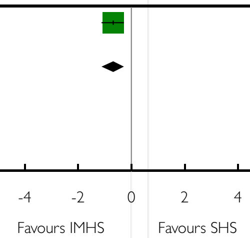
Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 10 Mean limb shortening (cm)

Study or subgroup	IMHS N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Hardy 1998	27	0.6 (0.69)	37	1.3 (1.08)		100.0 %	-0.70 [-1.13, -0.27]
Total (95% CI)	**27**		**37**			**100.0 %**	**-0.70 [-1.13, -0.27]**

Heterogeneity: not applicable

Test for overall effect: Z = 3.16 (P = 0.0016)



Analysis 3.11. Comparison 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS), Outcome 11 Final outcome measures.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 3 Intramedullary hip screw (IMHS) versus sliding hip screw (SHS)

Outcome: 11 Final outcome measures

Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Mortality					
Baumgaertner 1998	10/65	17/66		28.3 %	0.60 [0.30, 1.21]
Hardy 1998	15/50	15/50		25.1 %	1.00 [0.55, 1.82]
Harrington 2002	20/50	19/52		31.2 %	1.09 [0.67, 1.79]
Hoffmann 1999	9/56	9/54		15.4 %	0.96 [0.41, 2.24]
Subtotal (95% CI)	**221**	**222**		**100.0 %**	**0.91 [0.67, 1.24]**
Total events: 54 (IMHS), 60 (SHS)					
Heterogeneity: Chi^2 = 2.03, df = 3 (P = 0.57); I^2 =0.0%					
Test for overall effect: Z = 0.59 (P = 0.55)					
2 Pain					
Baumgaertner 1998	15/52	12/53		36.9 %	1.27 [0.66, 2.45]
Hardy 1998	9/35	4/35		12.4 %	2.25 [0.76, 6.63]
Hoffmann 1999	14/45	16/43		50.7 %	0.84 [0.47, 1.50]
Subtotal (95% CI)	**132**	**131**		**100.0 %**	**1.17 [0.79, 1.75]**
Total events: 38 (IMHS), 32 (SHS)					
Heterogeneity: Chi^2 = 2.75, df = 2 (P = 0.25); I^2 =27%					
Test for overall effect: Z = 0.78 (P = 0.43)					
3 Failure to return home (survivors)					
Baumgaertner 1998	18/52	14/53		44.0 %	1.31 [0.73, 2.35]
Harrington 2002	11/30	11/33		33.3 %	1.10 [0.56, 2.16]
Hoffmann 1999	7/45	7/43		22.7 %	0.96 [0.37, 2.50]
Subtotal (95% CI)	**127**	**129**		**100.0 %**	**1.16 [0.78, 1.73]**
Total events: 36 (IMHS), 32 (SHS)					
Heterogeneity: Chi^2 = 0.35, df = 2 (P = 0.84); I^2 =0.0%					
Test for overall effect: Z = 0.72 (P = 0.47)					
4 Failure to return home or dead					
Baumgaertner 1998	24/58	25/64		34.2 %	1.06 [0.69, 1.63]
Harrington 2002	31/50	30/52		42.3 %	1.07 [0.78, 1.48]
Hoffmann 1999	16/54	16/52		23.5 %	0.96 [0.54, 1.72]
Subtotal (95% CI)	**162**	**168**		**100.0 %**	**1.04 [0.82, 1.33]**

0.1 0.2 0.5 1 2 5 10

Favours IMHS Favours SHS

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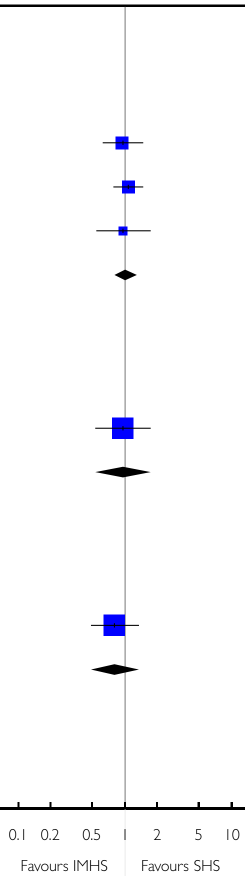
Study or subgroup	IMHS n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total events: 71 (IMHS), 71 (SHS)					
Heterogeneity: Chi² = 0.11, df = 2 (P = 0.95); I² =0.0%					
Test for overall effect: Z = 0.34 (P = 0.73)					
5 Failure to return home or dead (overall denominators used)					
Baumgaertner 1998	24/65	25/64		35.5 %	0.95 [0.61, 1.47]
Harrington 2002	31/50	30/52		41.5 %	1.07 [0.78, 1.48]
Hoffmann 1999	16/56	16/54		23.0 %	0.96 [0.54, 1.73]
Subtotal (95% CI)	**171**	**170**		**100.0 %**	**1.00 [0.79, 1.28]**
Total events: 71 (IMHS), 71 (SHS)					
Heterogeneity: Chi² = 0.27, df = 2 (P = 0.88); I² =0.0%					
Test for overall effect: Z = 0.03 (P = 0.98)					
6 Failure to regain mobility					
Baumgaertner 1998	15/52	16/53		100.0 %	0.96 [0.53, 1.73]
Subtotal (95% CI)	**52**	**53**		**100.0 %**	**0.96 [0.53, 1.73]**
Total events: 15 (IMHS), 16 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.15 (P = 0.88)					
7 Poor mobility					
Hoffmann 1999	16/45	19/43		100.0 %	0.80 [0.48, 1.35]
Subtotal (95% CI)	**45**	**43**		**100.0 %**	**0.80 [0.48, 1.35]**
Total events: 16 (IMHS), 19 (SHS)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.82 (P = 0.41)					



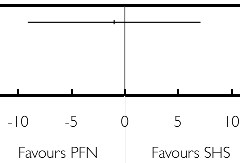
Analysis 4.1. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 1 Length of surgery (minutes)

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Saudan 2002	100	64 (33)	106	65 (26)		-1.00 [-9.14, 7.14]



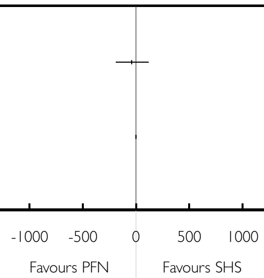
Analysis 4.2. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 2 Blood loss and transfusion.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 2 Blood loss and transfusion

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Blood loss (ml)						
Pajarinen 2005	54	320 (310)	54	357 (495)		-37.00 [-192.78, 118.78]
2 Transfusion (units of red blood cells)						
Pajarinen 2005	54	2.6 (2.4)	54	2.6 (2)		0.0 [-0.83, 0.83]



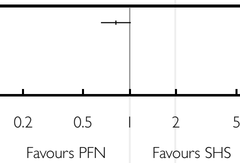
Analysis 4.3. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 3 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 3 Number of patients transfused

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Saudan 2002	55/100	72/106		0.81 [0.65, 1.01]



Analysis 4.4. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 4 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 4 Radiographic screening time (minutes)

Study or subgroup	PFN N	Mean(SD)	SHS N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Saudan 2002	100	4 (3)	106	3 (2)		1.00 [0.30, 1.70]

-4 -2 0 2 4

Favours PFN Favours SHS

Analysis 4.5. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 5 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 5 Fracture fixation complications

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Operative fracture femur				
Papasimos 2005	0/40	0/40		0.0 [0.0, 0.0]
Subtotal (95% CI)	**40**	**40**		**0.0 [0.0, 0.0]**
Total events: 0 (PFN), 0 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
2 Later fracture of femur				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Papasimos 2005	0/40	0/40		0.0 [0.0, 0.0]
Subtotal (95% CI)	**94**	**94**		**0.0 [0.0, 0.0]**
Total events: 0 (PFN), 0 (SHS)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P<0.00001); I^2 =0.0%				
Test for overall effect: Z = 0.0 (P < 0.00001)				
3 Cut-out				
Pajarinen 2005	1/54	1/54		1.00 [0.06, 15.58]

0.01 0.1 1 10 100

Favours PFN Favours SHS

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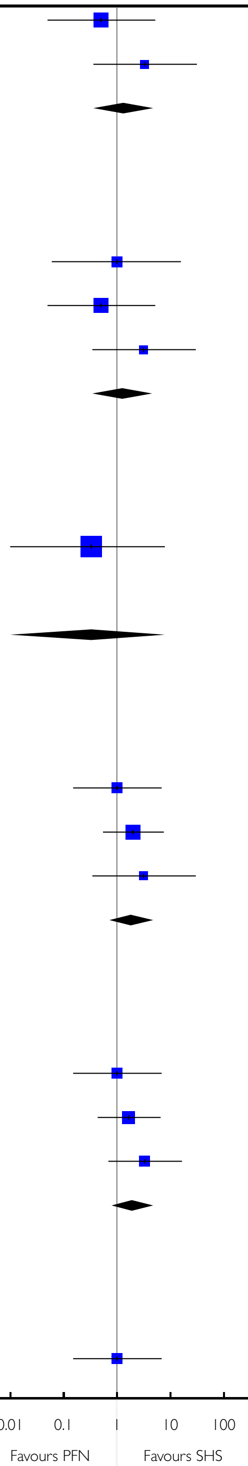
Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Saudan 2002	3/79	1/89		3.38 [0.36, 31.84]
Subtotal (95% CI)	**173**	**183**		**1.31 [0.36, 4.75]**
Total events: 5 (PFN), 4 (SHS)				
Heterogeneity: $Chi^2 = 1.36$, df = 2 (P = 0.51); I^2 =0.0%				
Test for overall effect: Z = 0.42 (P = 0.68)				
4 Cut-out: overall denominators used				
Pajarinen 2005	1/54	1/54		1.00 [0.06, 15.58]
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Saudan 2002	3/100	1/106		3.18 [0.34, 30.07]
Subtotal (95% CI)	**194**	**200**		**1.28 [0.35, 4.67]**
Total events: 5 (PFN), 4 (SHS)				
Heterogeneity: $Chi^2 = 1.27$, df = 2 (P = 0.53); I^2 =0.0%				
Test for overall effect: Z = 0.38 (P = 0.71)				
5 Non-union				
Papasimos 2005	0/40	1/40		0.33 [0.01, 7.95]
Saudan 2002	0/79	0/89		0.0 [0.0, 0.0]
Subtotal (95% CI)	**119**	**129**		**0.33 [0.01, 7.95]**
Total events: 0 (PFN), 1 (SHS)				
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.68 (P = 0.50)				
6 All technical complications of fixation				
Pajarinen 2005	2/54	2/54		1.00 [0.15, 6.84]
Papasimos 2005	6/40	3/40		2.00 [0.54, 7.45]
Saudan 2002	3/100	1/106		3.18 [0.34, 30.07]
Subtotal (95% CI)	**194**	**200**		**1.86 [0.71, 4.85]**
Total events: 11 (PFN), 6 (SHS)				
Heterogeneity: $Chi^2 = 0.63$, df = 2 (P = 0.73); I^2 =0.0%				
Test for overall effect: Z = 1.26 (P = 0.21)				
7 Reoperation				
Pajarinen 2005	2/54	2/54		1.00 [0.15, 6.84]
Papasimos 2005	5/40	3/40		1.67 [0.43, 6.51]
Saudan 2002	6/79	2/89		3.38 [0.70, 16.27]
Subtotal (95% CI)	**173**	**183**		**1.94 [0.80, 4.71]**
Total events: 13 (PFN), 7 (SHS)				
Heterogeneity: $Chi^2 = 0.98$, df = 2 (P = 0.61); I^2 =0.0%				
Test for overall effect: Z = 1.47 (P = 0.14)				
8 Reoperation: overall denominators used				
Pajarinen 2005	2/54	2/54		1.00 [0.15, 6.84]



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Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Papasimos 2005	5/40	3/40		1.67 [0.43, 6.51]
Saudan 2002	6/100	2/106		3.18 [0.66, 15.39]
Subtotal (95% CI)	**194**	**200**		**1.90 [0.78, 4.62]**
Total events: 13 (PFN), 7 (SHS)				
Heterogeneity: Chi^2 = 0.87, df = 2 (P = 0.65); I^2 =0.0%				
Test for overall effect: Z = 1.41 (P = 0.16)				

0.01 0.1 1 10 100

Favours PFN Favours SHS

Analysis 4.6. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 6 Wound infection or haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 6 Wound infection or haematoma

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Superficial wound infection				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Papasimos 2005	1/40	1/40		1.00 [0.06, 15.44]
Subtotal (95% CI)	**94**	**94**		**1.00 [0.06, 15.44]**
Total events: 1 (PFN), 1 (SHS)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.0 (P = 1.0)				
2 Deep wound infection				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Saudan 2002	3/79	1/89		3.38 [0.36, 31.84]
Subtotal (95% CI)	**133**	**143**		**3.38 [0.36, 31.84]**
Total events: 3 (PFN), 1 (SHS)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 1.06 (P = 0.29)				
3 Haematoma				
Papasimos 2005	3/40	3/40		1.00 [0.21, 4.66]
Subtotal (95% CI)	**40**	**40**		**1.00 [0.21, 4.66]**

0.01 0.1 1 10 100

Favours PFN Favours SHS

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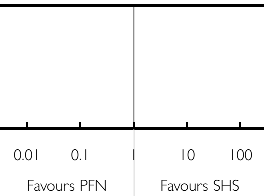
Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Total events: 3 (PFN), 3 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P = 1.0)				



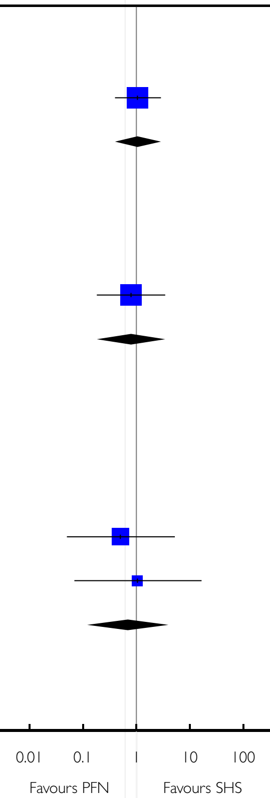
Analysis 4.7. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 7 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 7 Post-operative complications

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia				
Papasimos 2005	0/40	0/40		0.0 [0.0, 0.0]
Saudan 2002	7/100	7/106		1.06 [0.39, 2.91]
Subtotal (95% CI)	**140**	**146**		**1.06 [0.39, 2.91]**
Total events: 7 (PFN), 7 (SHS)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 0.11 (P = 0.91)				
2 Pressure sores				
Saudan 2002	3/100	4/106		0.80 [0.18, 3.46]
Subtotal (95% CI)	**100**	**106**		**0.80 [0.18, 3.46]**
Total events: 3 (PFN), 4 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.31 (P = 0.76)				
3 Deep vein thrombosis				
Pajarinen 2005	0/54	0/54		0.0 [0.0, 0.0]
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Saudan 2002	1/100	1/106		1.06 [0.07, 16.72]
Subtotal (95% CI)	**194**	**200**		**0.68 [0.12, 3.98]**
Total events: 2 (PFN), 3 (SHS)				
Heterogeneity: Chi^2 = 0.16, df = 1 (P = 0.68); I^2 =0.0%				



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Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Test for overall effect: Z = 0.42 (P = 0.67)				
4 Pulmonary embolism				
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Saudan 2002	1/100	1/106		1.06 [0.07, 16.72]
Subtotal (95% CI)	**140**	**146**		**0.68 [0.12, 3.98]**
Total events: 2 (PFN), 3 (SHS)				
Heterogeneity: $Chi^2 = 0.16$, df = 1 (P = 0.68); I^2 =0.0%				
Test for overall effect: Z = 0.42 (P = 0.67)				
5 Urinary tract infection				
Papasimos 2005	1/40	2/40		0.50 [0.05, 5.30]
Saudan 2002	34/100	23/106		1.57 [1.00, 2.47]
Subtotal (95% CI)	**140**	**146**		**1.48 [0.95, 2.30]**
Total events: 35 (PFN), 25 (SHS)				
Heterogeneity: $Chi^2 = 0.87$, df = 1 (P = 0.35); I^2 =0.0%				
Test for overall effect: Z = 1.73 (P = 0.083)				
6 Any medical complication				
Saudan 2002	52/100	49/106		1.12 [0.85, 1.49]
Subtotal (95% CI)	**100**	**106**		**1.12 [0.85, 1.49]**
Total events: 52 (PFN), 49 (SHS)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.83 (P = 0.41)				

0.01 0.1 1 10 100

Favours PFN Favours SHS

Analysis 4.8. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 8 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

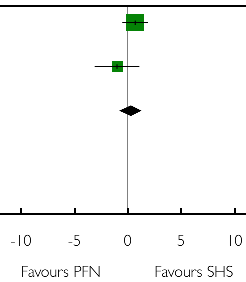
Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 8 Length of hospital stay (days)

Study or subgroup	PFN N	PFN Mean(SD)	SHS N	SHS Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Pajarinen 2005	54	6.1 (3.3)	54	5.4 (3)		75.0 %	0.70 [-0.49, 1.89]
Saudan 2002	100	13 (4)	106	14 (10)		25.0 %	-1.00 [-3.06, 1.06]
Total (95% CI)	**154**		**160**			**100.0 %**	**0.27 [-0.76, 1.30]**

Heterogeneity: Chi^2 = 1.96, df = 1 (P = 0.16); I^2 =49%

Test for overall effect: Z = 0.52 (P = 0.60)



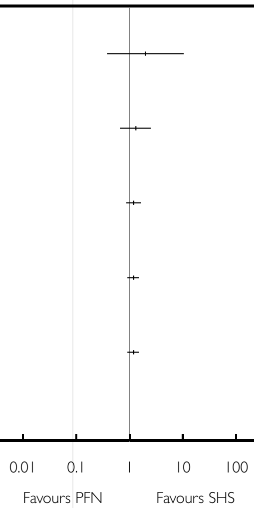
Analysis 4.9. Comparison 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS), Outcome 9 Final outcome measures.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 4 Proximal femoral nail (PFN) versus sliding hip screw (SHS)

Outcome: 9 Final outcome measures

Study or subgroup	PFN n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Mortality at 4 months				
Pajarinen 2005	4/54	2/54		2.00 [0.38, 10.47]
2 Mortality at 1 year				
Saudan 2002	16/100	13/106		1.30 [0.66, 2.57]
3 In nursing home at 1 year				
Saudan 2002	42/79	39/89		1.21 [0.89, 1.66]
4 In nursing home or dead at 1 year				
Saudan 2002	58/95	52/102		1.20 [0.93, 1.54]
5 In nursing home or dead at 1 year (overall denominators used)				
Saudan 2002	58/100	52/106		1.18 [0.92, 1.53]
6 Failure to regain pre-fracture residential status at 4 months				



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Study or subgroup	PFN	SHS	Risk Ratio	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI	M-H,Fixed,95% CI
Pajarinen 2005	8/42	9/41		0.87 [0.37, 2.03]
7 Failure to regain pre-fracture residential status, seriously ill or dead at 4 months				
Pajarinen 2005	18/52	20/52		0.90 [0.54, 1.50]
8 Failure to recover previous mobility at 4 months				
Pajarinen 2005	10/42	19/41		0.51 [0.27, 0.97]
9 Failure to recover previous mobility or dead at 4 months (overall denominators used)				
Pajarinen 2005	14/54	21/54		0.67 [0.38, 1.17]

0.01 0.1 1 10 100

Favours PFN Favours SHS

Analysis 5.1. Comparison 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 1 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 1 Fracture fixation complications

Study or subgroup	Targon PF nail	SHS	Risk Ratio	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI	M-H,Fixed,95% CI
1 Later fracture of the femur				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
2 Cut-out				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]
3 Non-union				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
4 All technical complications of fixation				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]
5 Reoperation				
Giraud 2005	3/34	2/26		1.15 [0.21, 6.37]

0.1 0.2 0.5 1 2 5 10

Favours Targon PF Favours SHS

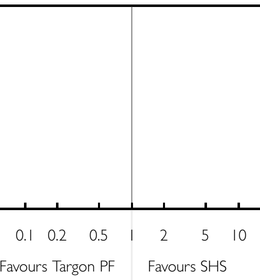
Analysis 5.2. Comparison 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 2 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 2 Wound infection

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 All wound infections				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]
2 Deep wound infection				
Giraud 2005	0/34	0/26		0.0 [0.0, 0.0]



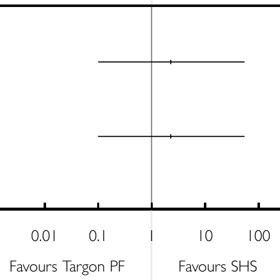
Analysis 5.3. Comparison 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 3 Post-operative compiications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 3 Post-operative compiications

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Pneumonia				
Giraud 2005	1/34	0/26		2.31 [0.10, 54.60]
2 Deep vein thrombosis				
Giraud 2005	1/34	0/26		2.31 [0.10, 54.60]



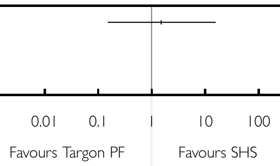
Analysis 5.4. Comparison 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS), Outcome 4 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 5 Targon PF (proximal femoral) nail versus sliding hip screw (SHS)

Outcome: 4 Mortality

Study or subgroup	Targon PF nail n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Giraud 2005	2/34	1/26		1.53 [0.15, 15.97]



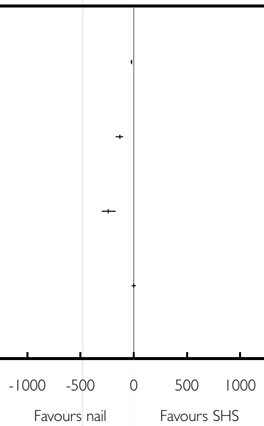
Analysis 6.1. Comparison 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 1 Operative details.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 1 Operative details

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Length of surgery (minutes)						
Dujardin 2001	30	24 (7)	30	46 (9)		-22.00 [-26.08, -17.92]
2 Operative blood loss (ml)						
Dujardin 2001	30	37 (39)	30	172 (76)		-135.00 [-165.57, -104.43]
3 Total blood loss (ml)						
Dujardin 2001	30	90 (75)	30	326 (161)		-236.00 [-299.56, -172.44]
4 Radiographic screening time (seconds)						
Dujardin 2001	30	62 (35)	30	63 (40)		-1.00 [-20.02, 18.02]



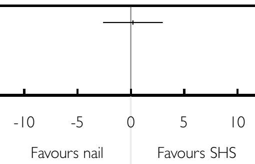
Analysis 6.2. Comparison 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 2 Time to radiographic healing (weeks).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 2 Time to radiographic healing (weeks)

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Dujardin 2001	30	10.4 (5.7)	30	10.2 (5.3)		0.20 [-2.59, 2.99]



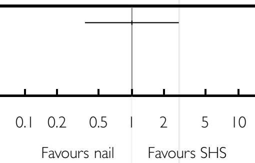
Analysis 6.3. Comparison 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 3 Mortality.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 3 Mortality

Study or subgroup	Mini-invasive nail n/N	Sliding hip screw n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Dujardin 2001	6/30	6/30		1.00 [0.36, 2.75]



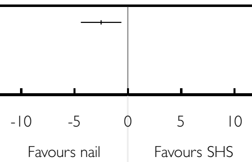
Analysis 6.4. Comparison 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS), Outcome 4 Time to effective weight bearing (weeks).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 6 Mini-invasive static (experimental) nail versus sliding hip screw (SHS)

Outcome: 4 Time to effective weight bearing (weeks)

Study or subgroup	Mini-invasive nail N	Mean(SD)	Sliding hip screw N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Dujardin 2001	21	5.8 (2.1)	22	8.3 (4)		-2.50 [-4.40, -0.60]



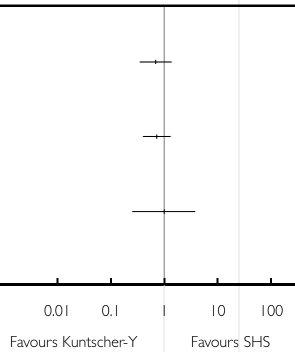
Analysis 7.1. Comparison 7 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 1 Fracture fixation complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 1 Fracture fixation complications

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Cut-out				
Davis 1988	12/116	17/114		0.69 [0.35, 1.39]
2 All fixation complications				
Davis 1988	16/116	22/114		0.71 [0.40, 1.29]
3 Reoperation				
Davis 1988	4/116	4/114		0.98 [0.25, 3.84]



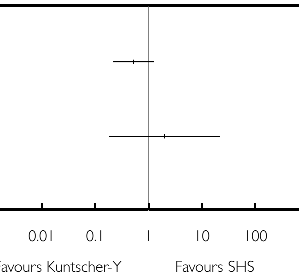
Analysis 7.2. Comparison 7 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 2 Wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 2 Wound infection

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Superficial wound infection				
Davis 1988	7/116	13/114		0.53 [0.22, 1.28]
2 Deep wound infection				
Davis 1988	2/116	1/114		1.97 [0.18, 21.38]



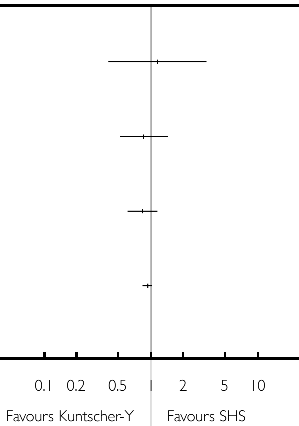
Analysis 7.3. Comparison 7 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 3 Post-operative complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 3 Post-operative complications

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Thromboembolic complications				
Davis 1988	7/116	6/114		1.15 [0.40, 3.31]
2 Pneumonia				
Davis 1988	21/116	24/114		0.86 [0.51, 1.45]
3 Pressure sores				
Davis 1988	42/116	50/114		0.83 [0.60, 1.14]
4 All medical complications				
Davis 1988	98/116	104/114		0.93 [0.84, 1.02]



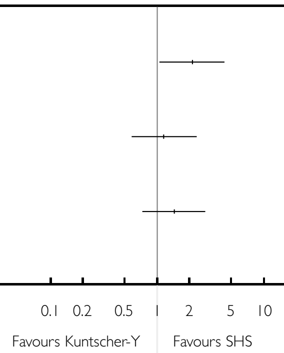
Analysis 7.4. Comparison 7 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 4 Anatomical deformity.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 4 Anatomical deformity

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Leg shortening				
Davis 1988	17/48	9/54		2.13 [1.05, 4.31]
2 Varus deformity				
Davis 1988	13/68	12/73		1.16 [0.57, 2.37]
3 External rotation deformity				
Davis 1988	14/48	11/54		1.43 [0.72, 2.85]



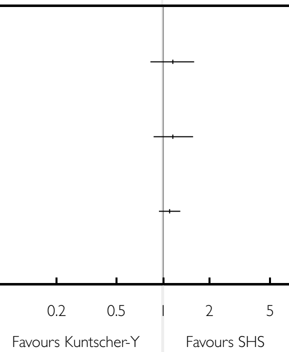
Analysis 7.5. Comparison 7 Kuntscher-Y nail versus sliding hip screw (SHS), Outcome 5 Final outcome measures.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 7 Kuntscher-Y nail versus sliding hip screw (SHS)

Outcome: 5 Final outcome measures

Study or subgroup	Kuntscher-Y n/N	SHS n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Mortality				
Davis 1988	48/116	41/114		1.15 [0.83, 1.60]
2 Failure to regain pre-fracture mobility				
Davis 1988	40/68	37/73		1.16 [0.86, 1.57]
3 Death or failure to regain pre-fracture mobility				
Davis 1988	88/116	78/114		1.11 [0.94, 1.30]



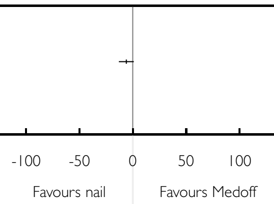
Analysis 8.1. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Intramedullary nail N	Mean(SD)	Medoff plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN)						
Ekstrom 2007	105	56 (21)	98	62 (29)		-6.00 [-13.01, 1.01]



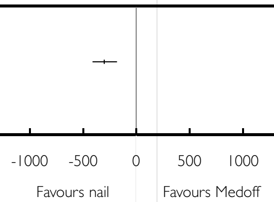
Analysis 8.2. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 2 Operative blood loss (mls).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 2 Operative blood loss (mls)

Study or subgroup	Intramedullary nail N	Mean(SD)	Medoff plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN)						
Ekstrom 2007	105	230 (185)	98	527 (565)		-297.00 [-414.33, -179.67]



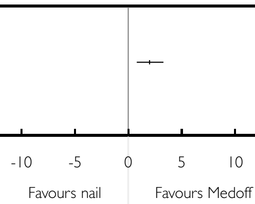
Analysis 8.3. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 3 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 3 Radiographic screening time (minutes)

Study or subgroup	Intramedullary nail		Medoff plate		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Fixed,95% CI	IV,Fixed,95% CI
1 Proximal femoral nail (PFN)						
Ekstrom 2007	105	7 (4)	98	5 (5)		2.00 [0.75, 3.25]



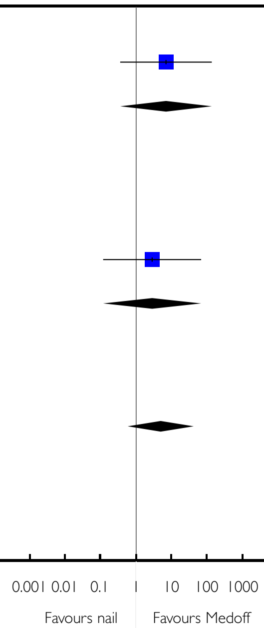
Analysis 8.4. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 4 Operative fracture of the femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 4 Operative fracture of the femur

Study or subgroup	Intramedullary nail	Medoff plate	Risk Ratio	Weight	Risk Ratio
	n/N	n/N	M-H,Fixed,95% CI		M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	3/109	0/108		49.3 %	6.94 [0.36, 132.70]
Subtotal (95% CI)	**109**	**108**		**49.3 %**	**6.94 [0.36, 132.70]**
Total events: 3 (Intramedullary nail), 0 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.29 (P = 0.20)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	1/105	0/98		50.7 %	2.80 [0.12, 67.98]
Subtotal (95% CI)	**105**	**98**		**50.7 %**	**2.80 [0.12, 67.98]**
Total events: 1 (Intramedullary nail), 0 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.63 (P = 0.53)					
Total (95% CI)	**214**	**206**		**100.0 %**	**4.84 [0.57, 40.81]**
Total events: 4 (Intramedullary nail), 0 (Medoff plate)					
Heterogeneity: Chi^2 = 0.17, df = 1 (P = 0.68); I^2 =0.0%					
Test for overall effect: Z = 1.45 (P = 0.15)					



Analysis 8.5. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 5 Later fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 5 Later fracture of femur

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	0/109	0/108		0.0 [0.0, 0.0]
Subtotal (95% CI)	**109**	**108**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
2 Proximal femoral nail (PFN)				
Ekstrom 2007	0/105	0/98		0.0 [0.0, 0.0]
Subtotal (95% CI)	**105**	**98**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**214**	**206**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Medoff plate)				
Heterogeneity: $Chi^2 = 0.0$, df = 0 (P<0.00001); I^2 =0.0%				
Test for overall effect: Z = 0.0 (P < 0.00001)				

0.1 0.2 0.5 1 2 5 10

Favours nail Favours Medoff

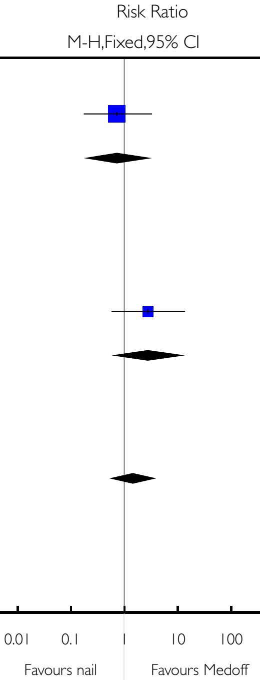
Analysis 8.6. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 6 Cut-out.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 6 Cut-out

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	3/109	4/108	66.0 %	0.74 [0.17, 3.24]
Subtotal (95% CI)	**109**	**108**	**66.0 %**	**0.74 [0.17, 3.24]**
Total events: 3 (Intramedullary nail), 4 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.40 (P = 0.69)				
2 Proximal femoral nail (PFN)				
Ekstrom 2007	6/105	2/98	34.0 %	2.80 [0.58, 13.55]
Subtotal (95% CI)	**105**	**98**	**34.0 %**	**2.80 [0.58, 13.55]**
Total events: 6 (Intramedullary nail), 2 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 1.28 (P = 0.20)				
Total (95% CI)	**214**	**206**	**100.0 %**	**1.44 [0.52, 4.01]**
Total events: 9 (Intramedullary nail), 6 (Medoff plate)				
Heterogeneity: $Chi^2 = 1.46$, df = 1 (P = 0.23); $I^2 = 31\%$				
Test for overall effect: Z = 0.70 (P = 0.48)				



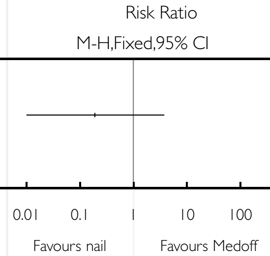
Analysis 8.7. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 7 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 7 Non-union

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)			
Ekstrom 2007	0/105	2/98	0.19 [0.01, 3.84]



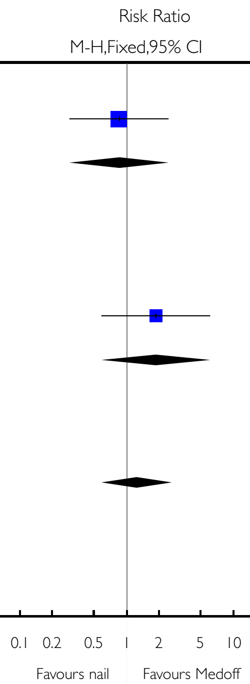
Analysis 8.8. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 8 All technical complications of fixation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 8 All technical complications of fixation

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	6/109	7/108	63.0 %	0.85 [0.29, 2.45]
Subtotal (95% CI)	**109**	**108**	**63.0 %**	**0.85 [0.29, 2.45]**
Total events: 6 (Intramedullary nail), 7 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.30 (P = 0.76)				
2 Proximal femoral nail (PFN)				
Ekstrom 2007	8/105	4/98	37.0 %	1.87 [0.58, 6.00]
Subtotal (95% CI)	**105**	**98**	**37.0 %**	**1.87 [0.58, 6.00]**
Total events: 8 (Intramedullary nail), 4 (Medoff plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 1.05 (P = 0.30)				
Total (95% CI)	**214**	**206**	**100.0 %**	**1.23 [0.57, 2.65]**
Total events: 14 (Intramedullary nail), 11 (Medoff plate)				
Heterogeneity: $Chi^2 = 0.96$, df = 1 (P = 0.33); $I^2 = 0.0\%$				
Test for overall effect: Z = 0.52 (P = 0.60)				



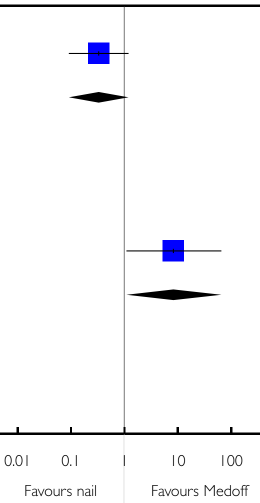
Analysis 8.9. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 9 Reoperation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 9 Reoperation

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	3/109	9/108		100.0 %	0.33 [0.09, 1.19]
Subtotal (95% CI)	**109**	**108**		**100.0 %**	**0.33 [0.09, 1.19]**
Total events: 3 (Intramedullary nail), 9 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.70 (P = 0.090)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	9/105	1/98		100.0 %	8.40 [1.08, 65.09]
Subtotal (95% CI)	**105**	**98**		**100.0 %**	**8.40 [1.08, 65.09]**
Total events: 9 (Intramedullary nail), 1 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.04 (P = 0.042)					



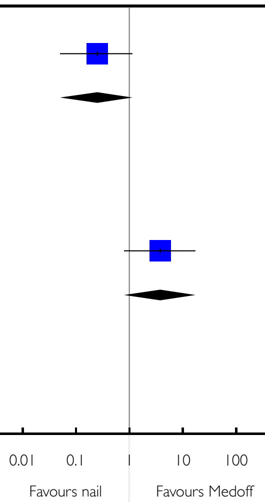
Analysis 8.10. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 10 Wound infection - any type.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 10 Wound infection - any type

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	2/109	8/108		100.0 %	0.25 [0.05, 1.14]
Subtotal (95% CI)	**109**	**108**		**100.0 %**	**0.25 [0.05, 1.14]**
Total events: 2 (Intramedullary nail), 8 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.79 (P = 0.073)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	8/105	2/98		100.0 %	3.73 [0.81, 17.15]
Subtotal (95% CI)	**105**	**98**		**100.0 %**	**3.73 [0.81, 17.15]**
Total events: 8 (Intramedullary nail), 2 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.69 (P = 0.090)					



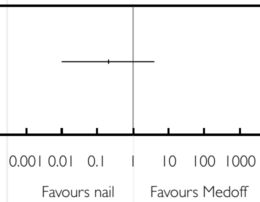
Analysis 8.11. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 11 Deep wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 11 Deep wound infection

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	0/109	2/108		0.20 [0.01, 4.08]



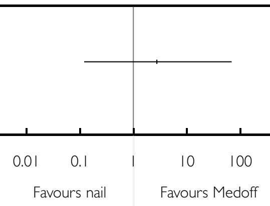
Analysis 8.12. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 12 Wound haematoma.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 12 Wound haematoma

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	1/105	0/98		2.80 [0.12, 67.98]



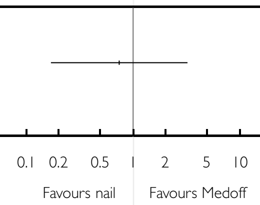
Analysis 8.13. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 13 Severe medical complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 13 Severe medical complications

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail				
Miedel 2005	3/109	4/108		0.74 [0.17, 3.24]



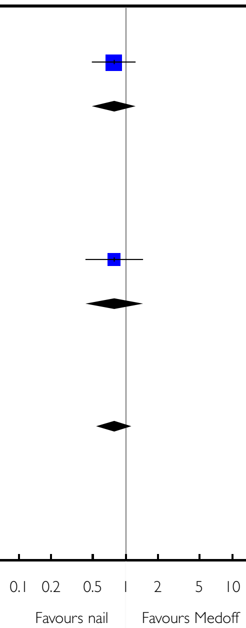
Analysis 8.14. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 14 Mortality at 1 year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 14 Mortality at 1 year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Gamma nail					
Miedel 2005	24/109	31/108		62.6 %	0.77 [0.48, 1.22]
Subtotal (95% CI)	**109**	**108**		**62.6 %**	**0.77 [0.48, 1.22]**
Total events: 24 (Intramedullary nail), 31 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.13 (P = 0.26)					
2 Proximal femoral nail (PFN)					
Ekstrom 2007	15/105	18/98		37.4 %	0.78 [0.42, 1.46]
Subtotal (95% CI)	**105**	**98**		**37.4 %**	**0.78 [0.42, 1.46]**
Total events: 15 (Intramedullary nail), 18 (Medoff plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.78 (P = 0.43)					
Total (95% CI)	**214**	**206**		**100.0 %**	**0.77 [0.53, 1.12]**
Total events: 39 (Intramedullary nail), 49 (Medoff plate)					
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.97); I^2 =0.0%					
Test for overall effect: Z = 1.37 (P = 0.17)					



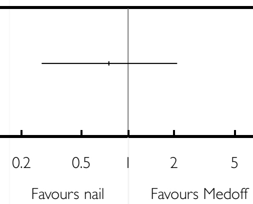
Analysis 8.15. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 15 Inability to walk 15 metres at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 15 Inability to walk 15 metres at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	6/64	7/56		0.75 [0.27, 2.10]



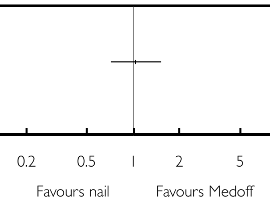
Analysis 8.16. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 16 Inability to rise from a chair at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 16 Inability to rise from a chair at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	31/64	26/56		1.04 [0.71, 1.52]



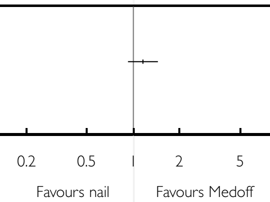
Analysis 8.17. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 17 Inability to climb a curb at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 17 Inability to climb a curb at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	50/64	38/56		1.15 [0.92, 1.44]



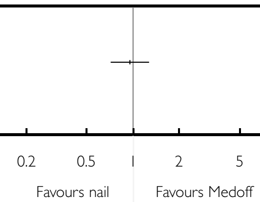
Analysis 8.18. Comparison 8 Femoral nail (2 types) versus Medoff sliding plate, Outcome 18 Need to use walking aids at one year.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 8 Femoral nail (2 types) versus Medoff sliding plate

Outcome: 18 Need to use walking aids at one year

Study or subgroup	Intramedullary nail n/N	Medoff plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN)				
Ekstrom 2007	38/64	35/56		0.95 [0.71, 1.27]



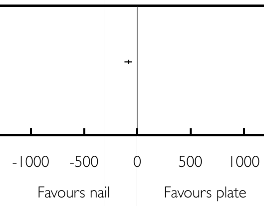
Analysis 9.1. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 1 Length of surgery (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 1 Length of surgery (minutes)

Study or subgroup	Intramedullary nail N	Mean(SD)	Plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)						
Sadowski 2002	20	82 (53)	19	166 (48)		-84.00 [-115.71, -52.29]



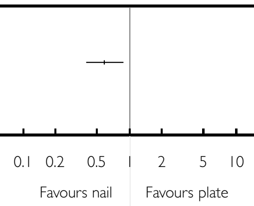
Analysis 9.2. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 2 Number of patients transfused.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 2 Number of patients transfused

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)			
Sadowski 2002	11/20	18/19	0.58 [0.39, 0.88]



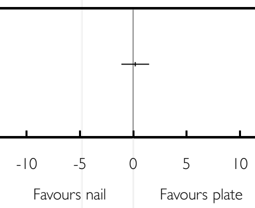
Analysis 9.3. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 3 Radiographic screening time (minutes).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 3 Radiographic screening time (minutes)

Study or subgroup	Intramedullary nail N	Mean(SD)	Plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)					
Sadowski 2002	20	4.2 (2.4)	19	4 (1.6)	0.20 [-1.07, 1.47]



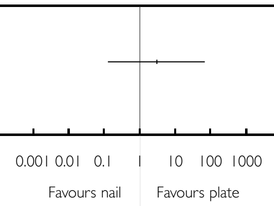
Analysis 9.4. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 4 Operative fracture of femur.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 4 Operative fracture of femur

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	1/13	0/13		3.00 [0.13, 67.51]



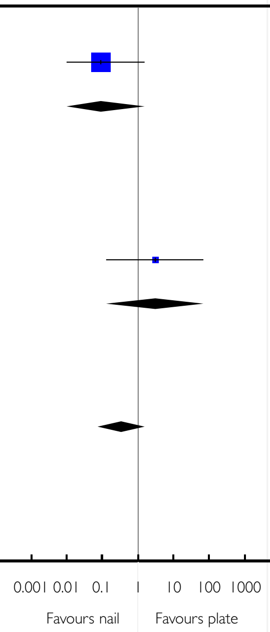
Analysis 9.5. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 5 Cut-out.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 5 Cut-out

Study or subgroup	Intramedullary nail n/N	fixation n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)					
Sadowski 2002	0/20	5/19		91.8 %	0.09 [0.01, 1.47]
Subtotal (95% CI)	**20**	**19**		**91.8 %**	**0.09 [0.01, 1.47]**
Total events: 0 (Intramedullary nail), 5 (fixation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.69 (P = 0.090)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	1/13	0/13		8.2 %	3.00 [0.13, 67.51]
Subtotal (95% CI)	**13**	**13**		**8.2 %**	**3.00 [0.13, 67.51]**
Total events: 1 (Intramedullary nail), 0 (fixation)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.69 (P = 0.49)					
Total (95% CI)	**33**	**32**		**100.0 %**	**0.32 [0.07, 1.53]**
Total events: 1 (Intramedullary nail), 5 (fixation)					
Heterogeneity: $Chi^2 = 2.80$, df = 1 (P = 0.09); I^2 =64%					
Test for overall effect: Z = 1.43 (P = 0.15)					



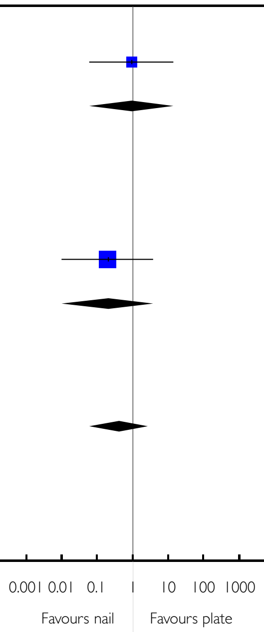
Analysis 9.6. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 6 Non-union.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 6 Non-union

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)					
Sadowski 2002	1/18	1/17		29.1 %	0.94 [0.06, 13.93]
Subtotal (95% CI)	**18**	**17**		**29.1 %**	**0.94 [0.06, 13.93]**
Total events: 1 (Intramedullary nail), 1 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.04 (P = 0.97)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	0/13	2/13		70.9 %	0.20 [0.01, 3.80]
Subtotal (95% CI)	**13**	**13**		**70.9 %**	**0.20 [0.01, 3.80]**
Total events: 0 (Intramedullary nail), 2 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.07 (P = 0.28)					
Total (95% CI)	**31**	**30**		**100.0 %**	**0.42 [0.06, 2.69]**
Total events: 1 (Intramedullary nail), 3 (Plate)					
Heterogeneity: $Chi^2 = 0.59$, df = 1 (P = 0.44); I^2 =0.0%					
Test for overall effect: Z = 0.92 (P = 0.36)					



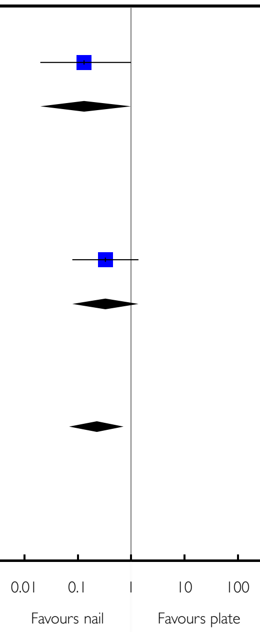
Analysis 9.7. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 7 All technical complications of fixation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 7 All technical complications of fixation

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)					
Sadowski 2002	1/18	7/17		54.5 %	0.13 [0.02, 0.98]
Subtotal (95% CI)	**18**	**17**		**54.5 %**	**0.13 [0.02, 0.98]**
Total events: 1 (Intramedullary nail), 7 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.98 (P = 0.048)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	2/13	6/13		45.5 %	0.33 [0.08, 1.36]
Subtotal (95% CI)	**13**	**13**		**45.5 %**	**0.33 [0.08, 1.36]**
Total events: 2 (Intramedullary nail), 6 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.53 (P = 0.12)					
Total (95% CI)	**31**	**30**		**100.0 %**	**0.23 [0.07, 0.71]**
Total events: 3 (Intramedullary nail), 13 (Plate)					
Heterogeneity: Chi^2 = 0.56, df = 1 (P = 0.46); I^2 =0.0%					
Test for overall effect: Z = 2.56 (P = 0.011)					



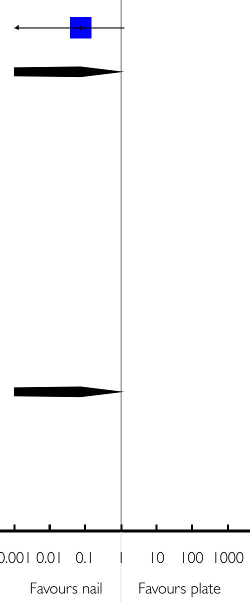
Analysis 9.8. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 8 Reoperation.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 8 Reoperation

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	0/20	6/19		0.07 [0.00, 1.22]
Subtotal (95% CI)	**20**	**19**		**0.07 [0.00, 1.22]**
Total events: 0 (Intramedullary nail), 6 (Plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 1.82 (P = 0.068)				
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	0/13	0/13		0.0 [0.0, 0.0]
Subtotal (95% CI)	**13**	**13**		**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Plate)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**33**	**32**		**0.07 [0.00, 1.22]**
Total events: 0 (Intramedullary nail), 6 (Plate)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P = 1.00); I^2 =0.0%				
Test for overall effect: Z = 1.82 (P = 0.068)				



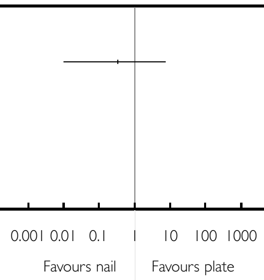
Analysis 9.9. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 9 Deep wound infection.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 9 Deep wound infection

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	0/18	1/17		0.32 [0.01, 7.26]
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	0/13	0/13		0.0 [0.0, 0.0]



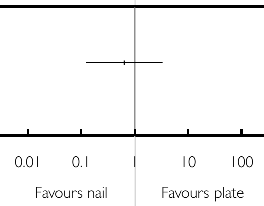
Analysis 9.10. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 10 Pneumonia.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 10 Pneumonia

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	2/20	3/19		0.63 [0.12, 3.38]



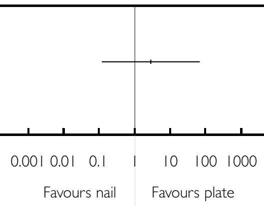
Analysis 9.11. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 11 Pressure sores.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 11 Pressure sores

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	1/20	0/19		2.86 [0.12, 66.11]



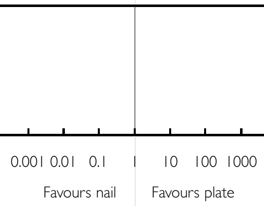
Analysis 9.12. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 12 Deep vein thrombosis.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 12 Deep vein thrombosis

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	0/20	0/19		0.0 [0.0, 0.0]



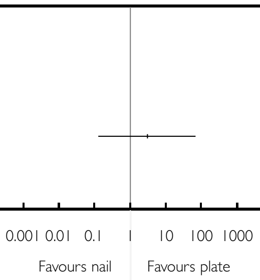
Analysis 9.13. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 13 Pulmonary embolism.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 13 Pulmonary embolism

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	0/20	0/19		0.0 [0.0, 0.0]
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	1/13	0/13		3.00 [0.13, 67.51]



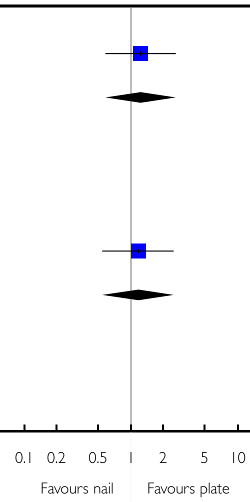
Analysis 9.14. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 14 All medical complications.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 14 All medical complications

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)					
Sadowski 2002	9/20	7/19		54.5 %	1.22 [0.57, 2.62]
Subtotal (95% CI)	**20**	**19**		**54.5 %**	**1.22 [0.57, 2.62]**
Total events: 9 (Intramedullary nail), 7 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.51 (P = 0.61)					
2 Gamma nail versus 90 degree blade plate					
Pelet 2001	7/13	6/13		45.5 %	1.17 [0.54, 2.53]
Subtotal (95% CI)	**13**	**13**		**45.5 %**	**1.17 [0.54, 2.53]**
Total events: 7 (Intramedullary nail), 6 (Plate)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.39 (P = 0.70)					



(Continued . . .)

(. . . *Continued*)

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Total (95% CI)	**33**	**32**		**100.0 %**	**1.20 [0.69, 2.06]**
Total events: 16 (Intramedullary nail), 13 (Plate)					
Heterogeneity: $Chi^2 = 0.01$, df = 1 (P = 0.93); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.65 (P = 0.52)					

0.1 0.2 0.5 1 2 5 10

Favours nail Favours plate

Analysis 9.15. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 15 Length of hospital stay (days).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 15 Length of hospital stay (days)

Study or subgroup	Intramedullary nail N	Mean(SD)	Plate N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)						
Sadowski 2002	20	13 (4)	19	18 (7)		-5.00 [-8.60, -1.40]

-10 -5 0 5 10

Favours nail Favours plate

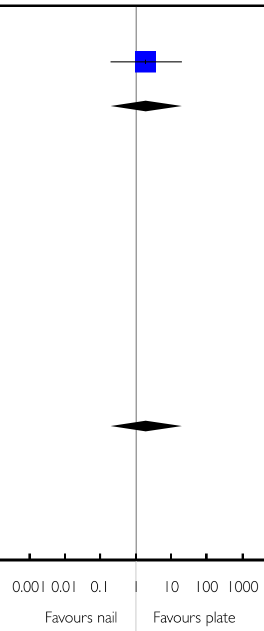
Analysis 9.16. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 16 Mortality (1 year).

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 16 Mortality (1 year)

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)			
Sadowski 2002	2/20	1/19	1.90 [0.19, 19.27]
Subtotal (95% CI)	**20**	**19**	**1.90 [0.19, 19.27]**
Total events: 2 (Intramedullary nail), 1 (Plate)			
Heterogeneity: not applicable			
Test for overall effect: Z = 0.54 (P = 0.59)			
2 Gamma nail versus 90 degree blade plate			
Pelet 2001	0/13	0/13	0.0 [0.0, 0.0]
Subtotal (95% CI)	**13**	**13**	**0.0 [0.0, 0.0]**
Total events: 0 (Intramedullary nail), 0 (Plate)			
Heterogeneity: not applicable			
Test for overall effect: Z = 0.0 (P < 0.00001)			
Total (95% CI)	**33**	**32**	**1.90 [0.19, 19.27]**
Total events: 2 (Intramedullary nail), 1 (Plate)			
Heterogeneity: Chi² = 0.0, df = 0 (P = 1.00); I² =0.0%			
Test for overall effect: Z = 0.54 (P = 0.59)			



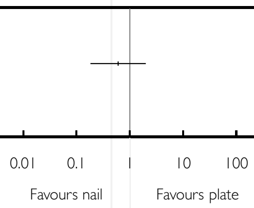
Analysis 9.17. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 17 Pain at follow up.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 17 Pain at follow up

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI
2 Gamma nail versus 90 degree blade plate			
Pelet 2001	3/13	5/13	0.60 [0.18, 2.01]



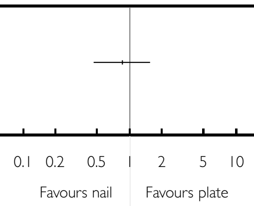
Analysis 9.18. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 18 In nursing home at one year from injury.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 18 In nursing home at one year from injury

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	9/18	10/17		0.85 [0.46, 1.56]



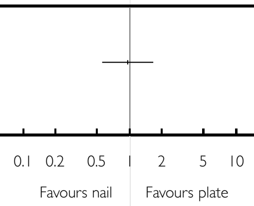
Analysis 9.19. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 19 In nursing home or dead at one year from injury.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 19 In nursing home or dead at one year from injury

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 Proximal femoral nail (PFN) versus Dynamic Condylar Plate (DCP)				
Sadowski 2002	11/20	11/19		0.95 [0.55, 1.65]



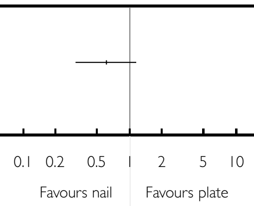
Analysis 9.20. Comparison 9 Femoral nail (2 types) versus condylar or blade plate, Outcome 20 Use of walking aids.

Review: Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults

Comparison: 9 Femoral nail (2 types) versus condylar or blade plate

Outcome: 20 Use of walking aids

Study or subgroup	Intramedullary nail n/N	Plate n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
2 Gamma nail versus 90 degree blade plate				
Pelet 2001	6/13	10/13		0.60 [0.31, 1.16]



A P P E N D I C E S

Appendix 1. Search strategies for The Cochrane Library and MEDLINE

The Cochrane Library	MEDLINE (OVID-WEB)
#1 MeSH descriptor Hip Fractures explode all trees #2 ((hip* or femur* or femoral* or trochant* or pertrochant* or intertrochant* or subtrochant* or intracapsular* or extracapsular*) NEAR fracture*):ti,ab,kw #3 (#1 OR #2) #4 4 (pin* or nail* or screw* or plate* or arthroplasty* or fix* or prosthes*):ti,ab,kw #5 MeSH descriptor Internal Fixators, this term only #6 MeSH descriptor Bone Screws, this term only #7 MeSH descriptor Fracture Fixation, Internal explode all trees #8 MeSH descriptor Bone Plates, this term only #9 MeSH descriptor Bone Nails, this term only #10 MeSH descriptor Arthroplasty explode all trees #11 (#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10) #12 (#3 AND #11)	1. exp Hip Fractures/ 2. hip$ or femur$ or femoral$ or trochant$ or pertrochant$ or intertrochant$ or subtrochant$ or intracapsular$ or extracapsular$)adj4 fracture$).tw. 3. or/1-2 4. (pin$1 or nail$ or screw$1 or plate$1 or arthroplast$ or fix$ or prosthes$).tw. 5. Internal Fixators/ or Bone Screws/ or Fracture Fixation, Internal/ or Bone Plates/ or Bone Nails/ 6. Arthroplasty/or Arthroplasty, Replacement, Hip/ 7. or/4-6 8. and/3,7

Appendix 2. Search strategy for EMBASE

EMBASE (OVID-WEB)
1. exp Hip Fracture/ 2. ((hip$ or ((femur$ or femoral$) adj3 (neck or proximal))) adj4 fracture$).tw. 3. or/1-2 4. exp Randomized Controlled trial/ 5. exp Double Blind Procedure/ 6. exp Single Blind Procedure/ 7. exp Crossover Procedure/ 8. Controlled Study/ 9. or/4-8 10. ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed)adj3 (trial or study)).tw. 11. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. 12. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. 13. (cross?over$ or (cross adj1 over$)).tw. 14. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. 15. or/10-14 16. or/9,15 17. limit 16 to human 18. and/3,17

Appendix 3. Searches prior to 2000

Search activity
Electronic searching of MEDLINE up to August 1999 with the following search terms: (Gamma and nail) and (screw and (dynamic or compression or Ambi)).
Handsearches of the following journals from 1990 when the first reports of the use of the Gamma nail were published: Journal of Bone and Joint Surgery - American Volume, Journal of Bone and Joint Surgery - British Volume, Acta Orthopaedica Scandinavica, Journal of Trauma, Injury, Clinical Orthopaedics, Orthopaedic Clinics of North America, International Orthopaedics, and Journal of Royal College of Surgeons (Edinburgh).
Handsearching of conference abstracts from 1990 reported within the Journal of Bone and Joint Surgery - American Volume, Journal of Bone and Joint Surgery - British Volume, Acta Orthopaedica Scandinavica Supplementum, and Injury.

WHAT'S NEW

Last assessed as up-to-date: 29 November 2007.

1 April 2008	Amended	Converted to new review format.
4 March 2008	New citation required and conclusions have changed	For the sixth substantive update, which first appeared in Issue 3, 2008, the main changes were as follows. (1) The search for trials was updated to June 2007. (2) Four newly identified studies (Ekstrom 2007; Giraud 2005; Ovesen 2006; Papasimos 2005) were included. (3) One new comparison was added (Targon PF nail versus SHS) and one category extended to include the PFN versus Medoff plate comparison. (4) One previously ongoing study (Khaleel) was moved to awaiting assessment and renamed Fernando 2006. (5) One newly identified study (Harris 2005) was added to awaiting assessment. (6) Five newly identified studies (Azzoni 2004; Bienkowski 2006; Kafer 2005; Klinger 2005; Tarantino 2005) were excluded. (7) Additional information and data for an already included trial were added (Mehdi 2000). (8) The 'Synopsis' was rewritten as a 'Plain language summary'; and other changes made to comply with format and methodological requirements. (9) There were no substantial changes made to the conclusions.

HISTORY

Protocol first published: Issue 2, 1995

Review first published: Issue 3, 1996

15 August 2005	New citation required and conclusions have changed	For details of this and previous updates please see Published notes.

CONTRIBUTIONS OF AUTHORS

Martyn Parker initiated and designed the review, usually contacted trialists for further information and compiled the first drafts of all versions. Helen Handoll located the review studies for most versions, occasionally contacted trialists for further information, always checked data entry and critically rewrote all drafts for all versions. All other tasks, including independent data extraction and quality assessment, were shared. Martyn Parker is the guarantor of the review.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- University of Teesside, Middlesbrough, UK.
- Peterborough and Stamford Hospitals NHS Foundation Trust, Peterborough, UK.

External sources

- No sources of support supplied

NOTES

The first substantive update appearing in Issue 2, 1999 involved an expansion of the original review, "Gamma nail versus sliding hip screw for extracapsular hip fractures", to include other cephalocondylic nails. Four more studies on the Gamma nail (Haynes 1996; Kukla 1997; Pahlpatz 1993; Park 1998), and two studies on the intramedullary hip screw (Baumgaertner 1998; Hardy 1998) were included.

For the second substantive update, which first appeared in Issue 1, 2002, the main changes were as follows.

1. The update of the search for trials to August 2001.

2. The inclusion of three new Gamma nail trials (Adams 2001; Kuwabara 1998; Michos 2001) and three new intermedullary hip screw trials (Harrington 1999; Hoffmann 1999; Mehdi 2000).

3. Two Gamma nail studies (Hogh 1992; Mott 1993) previously in studies awaiting assessment are now excluded as no further information has been forthcoming.

4. The inclusion of two new comparisons, each represented by one study: proximal femoral nail versus the sliding hip screw (Saudan 2001a) and proximal femoral nail versus the dynamic condylar screw (Saudan 2001b).

5. The inclusion of one trial on a mini-invasive nail (Dujardin 2001).

6. Peto odds ratios changed to relative risks in accordance with Cochrane Review Group requirements.

7. The addition of a new outcome, 'All technical complications of fixation' and the clarification of the outcome: 'operative fracture'.

8. Pooling of the results for key outcomes for three of the short proximal femoral nails (Gamma, IMHS and the PFN) versus the sliding hip screw.

9. Addition of a 'Synopsis'.

For the third substantive update, which first appeared in Issue 4, 2002, the main changes were as follows.

1. The update of the search for trials to August 2002.

2. Inclusion of newly identified study (Pelet 2001) comparing the Gamma nail with a blade plate.

3. Exclusion of another newly identified study (Dicicco 2000).

4. Incorporation of further details and results of three already included trials (Harrington 2002; Sadowski 2002; Saudan 2002), previously Harrington 1999, Saudan 2001b and Saudan 2001a respectively, obtained from newly published full reports of these trials.

5. Some restructuring of the text and tables to give emphasis on overall results of short femoral nails and lessen the emphasis on the outdated Kuntscher-Y nail.

6. Some adjustments to the 'Conclusions' but no substantive changes in implications.

For the fourth substantive update, which first appeared in Issue 1, 2004, the main changes were as follows.

1. The update of the search for trials to May 2003.

2. Newly identified study of Marques Lopez 2002 included.

3. Though a further report of Ahrengart 1994 was identified giving results for more patients we kept the results from the previous report, pending clarification.

4. Three newly identified studies (Hardy 2003; Herrera 2002; Nuber 2003) were excluded.

5. The studies of Davidson 1996 and Prinz 1996 were moved from 'Awaiting assessment' to excluded.

6. Study of Moran 2000 moved from ongoing to excluded.

7. Reference to letter on study of Hardy 1998 added.

8. Details of newly identified onging study (Parker) added.

For the fifth substantive update, which first appeared in Issue 4, 2005, the main changes were as follows.

(1) The search for trials was updated to June 2005.

(2) The newly identified studies of Miedel 2005, Pajarinen 2005 and Utrilla 2005 were included.

(3) Study of Mott 1993 moved from excluded to included on receipt of additional information.

(4) Three newly identified studies (Bhatti 2004; Khan 2002; Schipper 2004) were excluded.

(5) One newly identified study (Khaleel) is listed as an ongoing trial and two other studies (Ahmad; White) await assessment.

(6) The length of the 'Abstract' was reduced and other format changes undertaken to comply with the Cochrane Style Guide (November 2004). Other changes, such as the consideration of the I-squared statistic were made to comply with the Cochrane Handbook for Systematic Reviews of Interventions (March 2005).

(7) Graphical presentation of the results was revised and compressed to reduce the number of graphs.

(8) There were no substantial changes made to the conclusions.

INDEX TERMS

Medical Subject Headings (MeSH)

*Bone Nails; *Bone Screws; Fracture Fixation, Internal [adverse effects; *instrumentation]; Fracture Fixation, Intramedullary [adverse effects; instrumentation]; Hip Fractures [mortality; *surgery]; Randomized Controlled Trials as Topic

MeSH check words

Adult; Humans